NORTHEAST ELECTRONICS

A DIVISION OF NORTHERN TELECOM, INC.

INSTRUCTION MANUAL

# MODELS TTS-39A/B/D REFERENCE TONE GENERATOR

No. A0039-10-600 ISSUE 2 DATE AUG 1972

PRINTED IN U.S.A.

Airport Rd., Concord, N.H. 03301 • (603) 224-6521 • TELEX 94-3453

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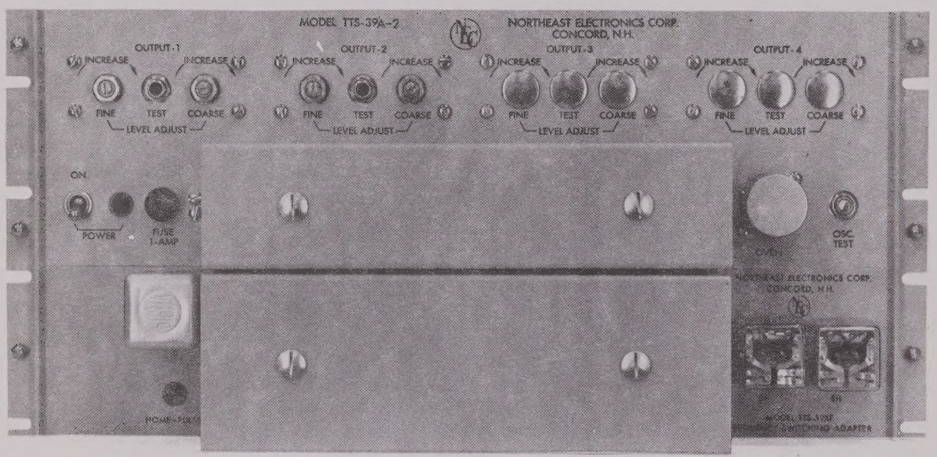
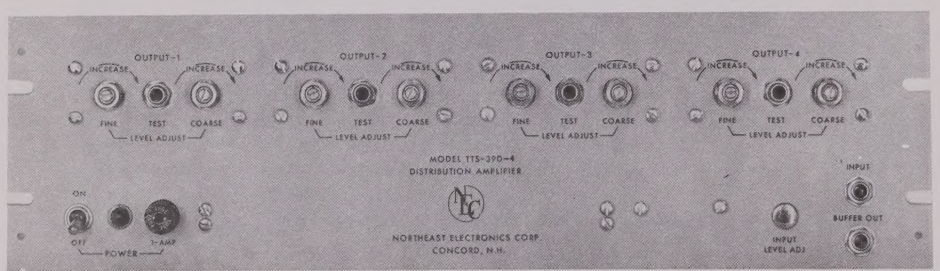


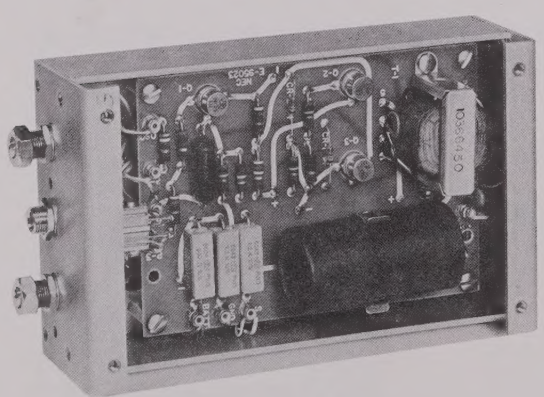



Figure 1-1. TTS 39A, TTS 39B, TTS 39XB, and TTS 39XF

# SECTION 1

# DESCRIPTION

## 1.1 INTRODUCTION.

1.2 The following paragraphs provide the description of the Models TTS 39A, TTS 39B, TTS 39D TTS 39XB and TTS 39XF.

## 1.3 MODEL TTS 39A.

1.4 The Northeast Electronics Corporation Model TTS 39A Reference Tone Generator consists of a rack mounting panel unit that includes a solid state, constant output oscillator and provisions for up to four Model TTS 39XB Output Amplifier Modules. Figure 1-1 shows the Model TTS 39A with two Output Amplifier Modules. The oscillator contained within the Model TTS 39A can also be used to drive external amplifiers, such as those included in the Model TTS 39D, as well as those contained internally.

## 1.5 MODEL TTS 39B.

1.6 The Northeast Electronics Corporation Model TTS 39B Reference Tone Generator is identical to the Model TTS 39A except that it is equipped with a cycling adapter that provides a ground contact at regular intervals, such as once every 10 seconds. This is used when on hook and off hook cycling is required for the Model TTS 39XB Output Amplifier Modules or when it is desired to provide interruptions in the output signal.

## 1.7 MODEL TTS 39D.

1.8 The Northeast Electronics Corporation Model TTS 39D Distribution Amplifier consists of a rack mounting panel unit that extends the output capacity of the Models TTS 39A and TTS 39B when more than four output stages are desirable. It is equipped with a solid state buffer amplifier, a buffer amplifier input and output jack and provisions for up to four Model TTS 39XB Output Amplifier Modules. The buffer amplifier provides isolation between the milliwatt source and the Output Amplifier Modules and buffer output jack.

## 1.9 MODEL TTS 39XB.

1.10 The Northeast Electronics Corporation Model TTS 39XB Output Amplifier Module (figure 1-1) provides the final balanced power output for the Models TTS 39A, TTS 39B and TTS 39D. Each module consists of a solid state amplifier, a dc blocked and balanced output transformer, coarse and fine output level controls to permit adjustment of output levels from -1 dBm to +2 dBm, a monitoring jack, space for mounting a hold coil and gas tube, a relay which can be used to start special functions, a relay for on and off hook cycling, and a transfer relay for special applications. The inputs of several of these modules can share a common signal source but the outputs are always independent of one another. Thus, trouble in one output has no effect on any of the others. No damage will result from the application of ringing voltages to the output of an Output Amplifier Module. Each Model TTS 39XB is provided with a test jack to monitor the output level. The insertion of a test cord into this jack disconnects the output from the connector appearance. The output impedance of the Model TTS 39XB can be altered from 900Ω to 600Ω by the addition of a strap, as shown in figure 3-1 and discussed in section 4 of this manual.

## 1.11 MODEL TTS 39XF.

1.12 The Northeast Electronics Corporation Model TTS 39XF Frequency Cycling Adapter (figure 1-1) consists of a rack mounting panel unit which supplies the oscillator circuit contained within the Model TTS 39A or TTS 39B Reference Tone Generators with values of capacitance and resistance to generate up to ten new frequencies. These new frequencies can be automatically cycled by a stepping switch contained within the Model TTS 39XF, in any sequence and at any predetermined time interval from 5 to 15 seconds. If additional frequencies are desired after the unit has been installed, components may be added in the field to include the desired frequencies in the cycling sequence. Any frequency from 300 to 10,000 Hz may be used and each output stage is designed to accommodate the full range of frequencies without affecting the output level established for one frequency. It may be desirable to provide the first frequency in the sequence with a longer time interval than the others. This would facilitate identifying the beginning of a new sequence of frequencies.

1.13 The Models TTS 39A, TTS 39B, TTS 39D and TTS 39XF are available in a TCC39 portable carrying case and are designed to operate from a well filtered 48 volt dc source.

## 1.14 OPTIONS FOR THE MODEL TTS 39XB OUTPUT AMPLIFIER MODULE.

1.15 The following options are provided for the Model TTS 39XB Output Amplifier Module:

OPTION 1: Provides a gas tube for tripping the ringing when the Model TTS 39A is used. No hold is included.

OPTION 2: Includes a hold coil for tripping the ringing and providing a hold on the line when the Model TTS 39A is used.

OPTION 3: Provides the hold circuits and relays required to provide on and off hook cycling; the hold coil also trips the ringing. This option is used in conjunction with the Model TTS 39B.

OPTION 4: Provides start circuits for initiating frequency cycling when the Model TTS 39XF Frequency Cycling Adapter is used in conjunction with either the Model TTS 39A or TTS 39B Reference Tone Generator.

OPTION 5: Combination of options 1 and 4 for use in conjunction with the Model TTS 39A Reference Tone Generator.

OPTION 6: Combination of options 2 and 4 for use in conjunction with the Model TTS 39A Reference Tone Generator.

OPTION 7: Priority sequence used when two outputs are required with frequency cycling. This option insures that cycling will begin with the first frequency.

OPTION 8: Balanced termination at the end of cycling.

OPTION 9: Relays and hold coil provide on and off hook cycling when used with the Model TTS 39XF for the Model TTS 39A only.

TTS 39 MK-1: Provides the delayed application of the milliwatt at the output of the Model TTS 39XB Output Amplifier Module.

# SECTION 2

# SPECIFICATIONS

## 2.1 INTRODUCTION.

2.2 Table 2-1 provides the specifications of the Models TTS 39A and TTS 39B. Table 2-2 provides the specifications of the Model TTS 39D and Table 2-3 provides the specifications of the TTS 39XF.

Table 2-1 Models TTS 39A and TTS 39B Reference Tone Generators

NOTE

The standard output frequency of the Models TTS 39A and TTS 39B is 1000 Hz, another frequency within the range from 300 Hz to 10,000 Hz will be supplied on request. If multifrequency operation is desired, the Model TTS 39XF Frequency Cycling Adapter can be used in conjunction with the Model TTS 39A or TTS 39B to provide up to ten frequencies within the range from 300 Hz to 10,000 Hz. It is suggested that the first frequency in the sequence be 1000 Hz.

| | |
|---|---|
| Frequency Tolerance: | ±1% |
| Harmonic Distortion: | $\leq$ 1%; 50 to 110° F |
| Output Level: | 0 dBm nominal; The output level of the Model TTS 39XB Output Amplifier Module is adjusted from -1 dBm to +2 dBm. |
| Output Level Variations: | $\leq$ 0.10 dBm; 50 to 110° F. |
| | NOTE<br>At a given temperature the output level is held to better than 0.05 dBm. $\leq$ 0.05 dBm; 42 to 50 volts dc |
| Supply Voltage: | 48 volts dc ±10% |
| Current Drain: | 500 mA max. |
| Size: | $5\frac{1}{4}$"h x 19"w |
| Weight: | 10 lb (Model TTS 39A-1, TTS 39B-1) |
| | NOTE<br>Add 1 lb for every additional Output Amplifier Module used. |

Table 2-2. Model TTS 39D Distribution Amplifier

NOTE

The electrical performance of the Model TTS 39D is dependent on that of the milliwatt source and the Model TTS 39XB Output Amplifier Module. The buffer amplifier included in the Model TTS 39D is, for all practical purposes, not affected by normal temperature and battery voltage variations.

| | |
|---|---|
| Supply Voltage: | 48 volts dc ±10% |
| Current Drain: | 500 mA max. |
| Size: | $5\frac{1}{4}$"h x 19"w |
| Weight: | 8 lb (Model TTS 39D-1) |

NOTE

Add 1 lb for every additional Output Amplifier Module used.

Table 2-3. Model TTS 39XF Frequency Cycling Adapter

| | |
|---|---|
| Frequency Switching Time: | Any time within the range from 5 to 15 seconds will be supplied on request. |
| Supply Voltage: | 48 volts dc ±10% |
| Current Drain: | 450 mA max. |
| Size: | $3\frac{1}{2}$"h x 19"w |
| Weight: | 11 lb. |

# SECTION 3

# INSTALLATION AND OPERATION

3.1 INTRODUCTION.

3.2 Before an attempt is made to install and operate any of the test equipment included in this manual, a thorough visual inspection should be performed to determine if any damage has been incurred during shipment.

3.3 INSTALLATION.

3.4 The installation instructions for Models TTS 39A and TTS 39B are provided by paragraphs 3.5 through 3.8 in conjunction with figure 3-1. The installation instructions for Model TTS 39D are provided by paragraphs 3.9 and 3.10 in conjunction with figure 7-2. The installation instructions for Model TTS 39XF are provided by paragraphs 3.11 and 3.12 in conjunction with figure 3-2.

3.5 MODELS TTS 39A AND TTS 39B.

3.6 Connect a well filtered 48 volt dc source to terminals 1 and 2 of terminal board TB-1, located on the rear of the Model TTS 39A or TTS 39B. Positive (+) is connected to terminal 2 and negative to terminal 1. The Model TTS 39A or TTS 39B will operate over the voltage range from 44 to 52 volts dc. A direct line to the dc buss should be provided. If this is not feasible, thorough tests must be made to insure that the voltage across terminals 1 and 2 will always remain within the specified range regardless of other loads that may be connected to or disconnected from the common supply line.

3.7 Each of the Model TTS 39XB Output Amplifier Modules included within the Model TTS 39A or TTS 39B is normally connected to an especially assigned subscriber number in the dial equipment. The line circuits normally associated with these subscriber appearances must be disconnected. This is necessary to avoid a permanent off hook condition in the line circuit and to remove all dc voltages from the tip and ring leads when the Model TTS 39A or TTS 39B is in the idle condition. The tip, ring and sleeve of each subscriber number assigned to the Model TTS 39A or TTS 39B should be connected to terminals 1, 2 and 8 respectively on each of the Model TTS 39XB Output Amplifier Modules.

3.8 Each of the Model TTS 39XB Output Amplifier Modules can provide an output impedance of either 600Ω or 900Ω. Figure 3-1 illustrates the strapping arrangement for each impedance. Should the impedance be altered in the field, the output level must be readjusted to meet the correct requirements. It is necessary to allow a half hour warm-up period prior to the readjustment of level, as the temperature controlled oven within the oscillator circuitry of the Model TTS 39A or TTS 39B must stabilize.

3.9 MODEL TTS 39D.

3.10 Connect a well filtered 48 volt dc source to the terminals provided on the rear of the Model TTS 39D observing the proper polarity. The Model TTS 39D will operate over a voltage range from 44 to 52 volts dc. A direct line to the dc buss should be provided. If this is not feasible, thorough tests must be made to insure that the voltage across the input terminals will always remain within the specified range regardless of other loads that may be connected to or disconnected from the common supply line. All of the other necessary wiring connections to the Model TTS 39D are illustrated on figure 7-3. The oscillator input from terminal 12 of TB1 located on the Model TTS 39A or TTS 39B Reference Tone Generator must be connected to the IN-1 terminal of the Model TTS 39D Distribution Amplifier. For installations requiring more than one Model TTS 39D Distribution Amplifier, connect the IN-1 terminal of each successive Model TTS 39D to the BUFFER OUTPUT terminal of the Model TTS 39D preceding it. By connecting the Distribution Amplifiers in this manner, the input impedance of only one Model TTS 39D is bridged across the output of the Model TTS 39A or TTS 39B generator. Therefore, as many of the Model TTS 39D Distribution Amplifier units as necessary can be installed with no overload effect on the generator.

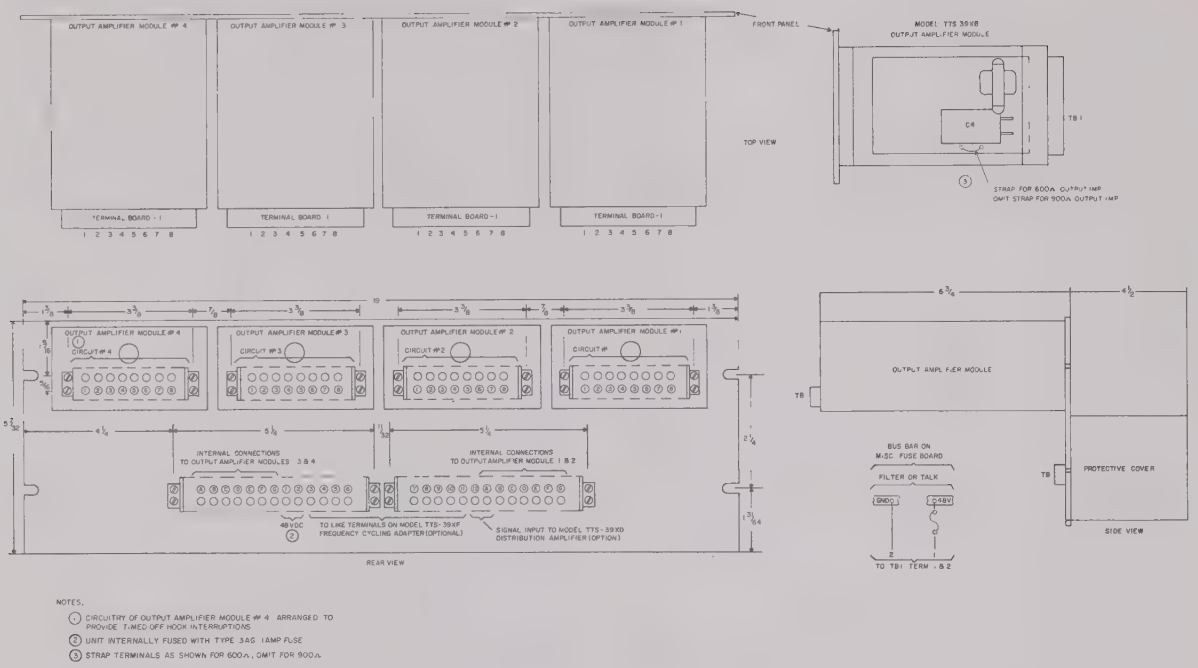
3.11 MODEL TTS 39XF.

3.12 The connections to the Model TTS 39XF from the Model TTS 39A or TTS 39B are illustrated on figure 3-3.

3.13 OPERATION.

3.14 Table 3-1 lists the function of each operating control, indicator and access point shown indexed for the Model TTS 39A and TTS 39B on figure 3-3. Table 3-2 lists the function of each control, indicator and access point shown indexed for the Model TTS 39D on figure 3-4.

3.15 The Model TTS 39XF contains a HOME &




NOTES.

1. CIRCUITRY OF OUTPUT AMPLIFIER MODULE #4 ARRANGED TO PROVIDE TIMED OFF HOOK INTERRUPTIONS
2. UNIT INTERNALLY FUSED WITH TYPE 3AG 1AMP FUSE
3. STRAP TERMINALS AS SHOWN FOR 600Λ, OMIT FOR 900Λ

Figure 3-1. TTS 39A/B Installation Diagram

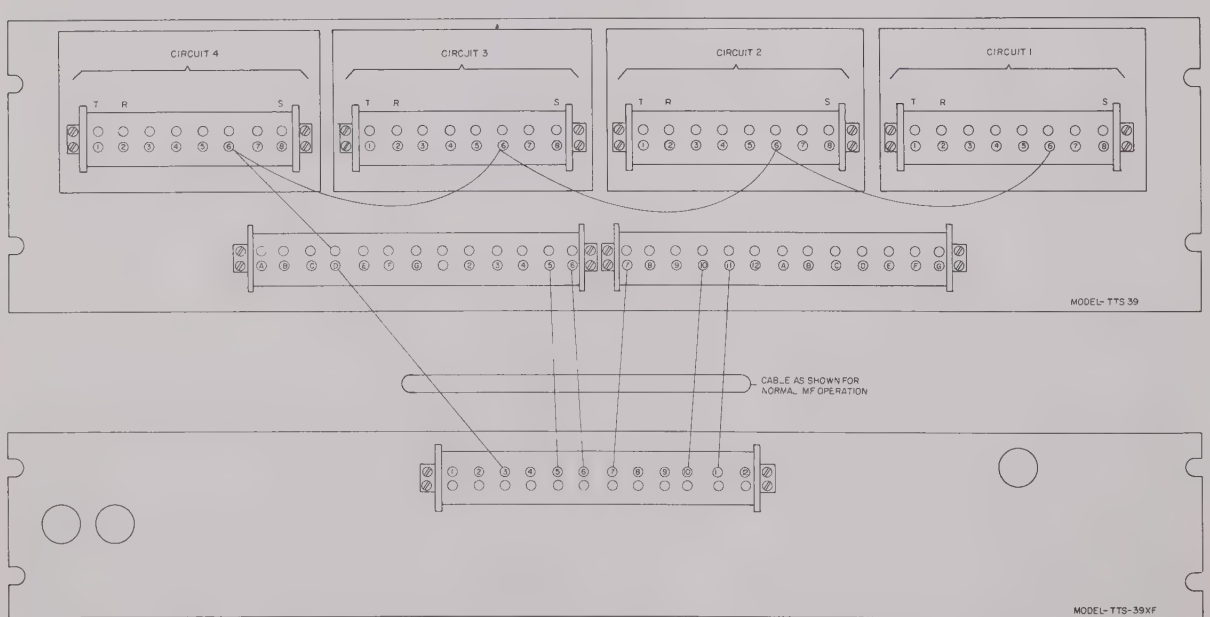



Figure 3-2. TTS 39A/B and TTS 39XF Connection Diagram

PULSE lamp that is illustrated on figure 3-3. This lamp is lighted when the frequency selector switch is in the HOME position and flashes at each change of frequency.

3.16 The operation of this group of instruments is obvious, therefore, no specific operating procedures are included in this manual. However, a few words of caution should be introduced here. It is necessary to allow at least a half hour warm up period before any level adjustments are attempted, as the temperature controlled oven contained within the oscillator circuitry must stabilize. The normal output level for units that have been adjusted for 0 dBm will be in the order of +2.5 dBm when first turned on. The output level will decrease and stabilize at 0 dBm when the oven reaches its operating temperature. Level adjustments can be made with the COARSE and FINE controls, but should only be made after the oven has reaches its operating temperature.

Table 3-1. Models TTS 39A AND TTS 39B

| Ref Desig | Control, Indicator or Access Point | Description |
|---|---|---|
| S1, DS1, F1 | POWER switch, lamp and fuse | Applies power to and provides current protection for the circuitry within the test set. |
| R17 | Fine Level Adjust | Provides a fine output level adjustment for the Model TTS 39XB Output Amplifier Module. |
| J1 | Output Test jack | Provides a receptical for a 310 type telephone plug for monitoring the output level of the Model TTS 39XB Output Amplifier Module. |
| R3 | Coarse Level Adjust | Provides a coarse output level adjustment for the Model TTS 39XB Output Amplifier Module. |
| J1 | OSC Test | Provides a receptical for a 310 type telephone plug for monitoring the output level of the oscillator circuitry. |

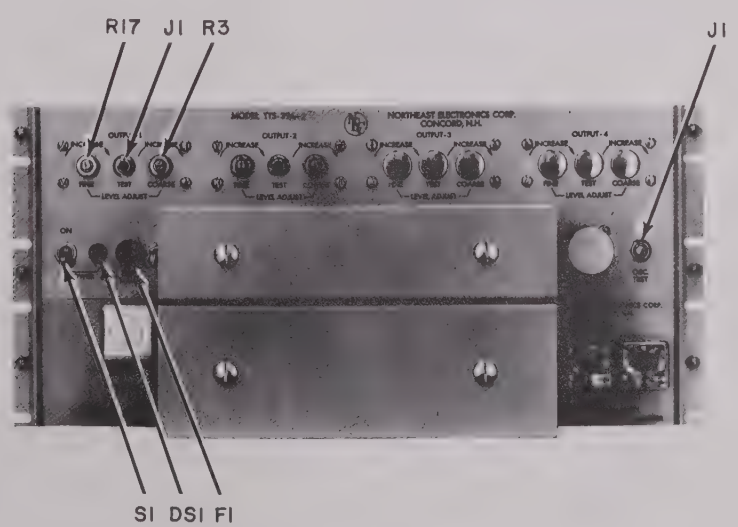



Figure 3-3. TTS 39A/B Controls, Indicators, and Access Points

Table 3-2. Model TTS 39D

| Ref Desig | Control, Indicator or Access Point | Description |
|---|---|---|
| S1, DS1, F1 | POWER switch, lamp and fuse | Applies power to and provides current protection for the circuitry within the test set. |
| R17 | Fine Level Adjust | Provides a fine output level adjustment for the Model TTS 39XB Output Amplifier Module. |
| J1 | Output Test jack | Provides a receptical for a 310 type telephone plug for monitoring the output level of the Model TTS 39XB Output Amplifier Module. |
| R3 | Coarse Level Adjust | Provides a coarse output level adjustment for the Model TTS 39XB Output Amplifier Module. |
| J1 | Input jack | Provides a receptical for a 310 type telephone plug for monitoring the input signal to the buffer amplifier circuit. |
| J2 | Buffer Out jack | Provides a receptical for a 310 type telephone plug for monitoring the output of the buffer amplifier. |
| R1 | Input Level Adj. potentiometer | Normalizes the input level to the buffer amplifier. |

Figure 3-4. TTS 39D Controls, Indicators, and Access Points

# SECTION 4

# CIRCUIT DESCRIPTION

## 4.1 INTRODUCTION.

4.2 Paragraphs 4.3 through 4.12 in conjunction with figure 7-1 provide the circuit description of the Model TTS 39A Reference Tone Generator. Paragraphs 4.13 through 4.15 in conjunction with figure 7-2 provide the circuit description of the Model TTS 39B Reference Tone Generator. Paragraphs 4.16 through 4.22 in conjunction with figure 7-3 provide the circuit description of the Model TTS 39D Distribution Amplifier. Paragraphs 4.23 through 4.25 in conjunction with figure 7-4 provide the circuit description of the Model TTS 39XB Output Amplifier Module. Paragraphs 4.26 through 4.34 in conjunction with figure 7-5 provide the circuit description of the Model TTS 39XF Frequency Cycling Adapter. Paragraphs 4.35 through 4.45 in conjunction with figures 7-8 through 7-15 provide the circuit description of the options for the Model TTS 39XB Output Amplifier Module.

## 4.3 MODEL TTS 39A REFERENCE TONE GENERATOR.

4.4 The Model TTS 39A Reference Tone Generator consists of a basic rack mounting panel containing the terminals, wiring, oscillator and associated circuitry necessary to accommodate up to four Model TTS 39XB Output Amplifier Modules. Terminals are also provided for the connection of the Model TTS 39XF Frequency Cycling Adapter and the Model TTS 39D Distribution Amplifier panel units.

4.5 Common fusing, power switching, reverse voltage protection and power on indications for the Models TTS 39A and TTS 39XF are provided by F1, S1, CR1, and DS1 respectively.

4.6 A series voltage reduction is provided for the 24 volt temperature controlled oven by R31. Spark suppression is provided for the switch contacts of the oven by C12. The correct operating voltage of the oven is 24 volts dc at pin 3 when the element is heating.

4.7 Decoupling between the battery and the oscillator amplifier is provided by R35 and C10. A voltage division and filtering is provided by R32, R34 and C11.

4.8 The output of the oscillator amplifier is ac coupled to the connection point for the Model TTS 39D Distribution Amplifier on TB1 by C4. The OSC TEST jack (J1) also provides access to the output of the oscillator amplifier for monitoring purposes.

CAUTION

Damage to the thermistor contained within the oven may result should voltage be applied to the OSC TEST jack.

4.9 Terminals A through G of terminal board TB1 provide the internal connections to the Model TTS 39XB Output Amplifier Modules. These connections include battery, ground, signal input and control circuits. Terminals 3 through 11 provide the connections for the addition of the Model TTS 39XF Frequency Cycling Adapter.

4.10 Oscillator Amplifier. The oscillator amplifier circuit contained within the Models TTS 39A and TTS 39B is illustrated by figure 7-6. The circuit consists of an r-c bridge-T oscillator and a three stage voltage amplifier. The oscillator employs wideband positive and resonant negative feedback loops in the performance of its function. The positive feedback is ac coupled from the emitter of Q2 to the emitter of Q1 through the coupling capacitor C2 and the level stabilizing element of DS1. The negative feedback is ac coupled from the emitter of Q2 to the base of Q1 through coupling capacitor C3, the resonant network consisting of C4, C5, high Z and low Z, impedance transformation Q3 and coupling capaciator C1. A portion of the emitter resistance of Q1 is variable to provide the adjustment of positive feedback.

4.11 Over a wide range of frequencies the positive feedback applied to the emitter of Q1 is overcome by the negative feedback at the base. However, at its resonant frequency the bridge-T network decreases the negative feedback sufficiently to permit oscillation.

4.12 The three stage amplifier consists of one stage of voltage amplification (Q4) and two cascaded emitter followers (Q5 & Q6) that provide current amplification. The input of the amplifier is ac coupled to R19 by C6. The output of the amplifier is ac coupled to the thermistor contained within the temperature controlled oven by C7. The output level adjustment of the oscillator amplifier is provided by R19.

## 4.13 MODEL TTS 39B REFERENCE TONE GENERATOR.

4.14 The Model TTS 39B Reference Tone Generator is identical to the Model TTS 39A Reference Tone Generator discussed in paragraphs 4.3 through 4.12 except that the Model TTS 39B also includes a time cycle generator as standard equipment. The time cycle generator provides the time base for the cycling on and off hook supervision when used in conjunction with Model TTS 39XB Output Amplifier Modules equipped with option 3. The start ground for the time cycle generator is derived through an isolating diode from the sleeve circuit of the Model TTS 39XB Output Amplifier Module provided with option 3.

4.15 Time Cycle Generator. The time cycle generator contained within the Model TTS 39B is illustrated by figure 7-7. The -48 volt power input to the time cycle generator circuit is protected against power reversals by CR1. The time cycling of this circuit is a function of two r-c time constants and the switch contacts of two relays. To illustrate the operation of this circuit, assume that a ground is applied to the S lead. At this time C1 charges through R6 and the break contacts of K2 until the voltage appearing at the base of Q1 reaches approximately 8 volts dc causing it to conduct. The selected value of R6 determines the rise time and produces a time constant of one second. When Q1 conducts, K1 operates interrupting the ground circuit to terminal 5 over its make contacts. Terminal 5 is connected to terminal G of TB1 located on the basic panel. At this time, K2 is allowed to operate through the break contacts of K1. When K2 operates, the charging path to C1 through R6 is broken and a dischagre circuit through R5 is established. The selected value of R5 determines the fall time and produces a time constant of 10 seconds. After C1 has discharged sufficiently to allow K1 to release, ground is again applied to terminal 5 and the charging circuit for C1 is re-established. This operation is repetitive and will continue until the ground is removed from the S lead.

4.16 MODEL TTS 39D DISTRIBUTION AMPLIFIER.

4.17 The Model TTS 39D distribution Amplifier is a basic rack mounting panel that provides the terminals, wiring, buffer amplifier and associated circuitry necessary to accommodate up to four Model TTS 39XB Output Amplifier Modules.

4.18 Fusing, power switching, reverse voltage protection and power on indications are provided by F1, S1, CR1 and DS1 respectively.

4.19 When the Model TTS 39D Distribution Amplifier is operated in conjunction with multifrequency options or options requiring timed interruptions and start circuits, the unit must be supplied with the proper interconnections to the Model TTS 39A or TTS 39B Reference Tone Generator with which it is to be used.

4.20 All of the options listed for the Model TTS 39XB Output Amplifier Modules also apply to the output modules supplied with the Model TTS 39D Distribution Amplifier.

4.21 Buffer Amplifier. The buffer amplifier is a single stage emitter follower that provides an impedance transformation from the input of the Model TTS 39D Distribution Amplifier to the inputs of the up to four Model TTS 39XB Output Amplifier Models contained within.

4.22 The input signal to the buffer amplifier is applied to terminal IN-1 of TB1. Additional input and output access is provided by J1 and J2 respectively. Transistor Q1 is operated as an emitter follower. The input and the output are ac coupled by C3 and C2 respectively. The collector supply voltage is provided by voltage divider R1 and R2 and filter capacitor C1.

4.23 MODEL TTS 39XB OUTPUT AMPLIFIER MODULE.

4.24 The Model TTS 39XB Output Amplifier Module consists of a stable buffer amplifier, a Darlington connected emitter follower pair and a ringing voltage protection network. This circuitry plus any optional circuitry that may also be included, is contained in a protective metal enclosure.

4.25 The input signal is coupled to the buffer amplifier stage through potentiometers R17 and R3. These controls provide the COARSE and FINE adjustments of output level over the range from -1 dBm to +2 dBm. The base of Q1 is ac coupled to the input signal by C1. The output of Q1 is ac coupled to the base of Q2 by C2. Transistors Q2 and Q3 are Darlington connected to provide the necessary current gain to drive the output circuitry. The output of Q3 is ac coupled to T1 by C3. Ringing voltage protection is provided by CR2, CR1, and R11. The split secondary of T1 is ac coupled by C4. The output impedance of T1 can be changed from 900 Ω to 600 Ω by shorting R13. The output of T1 is normally connected to terminals 1 and 2 of TB1 through the switch contacts of J1. However, when the jack is being used this connection is broken. The sleeve resistance to battery for external equipment is provided by R16. Isolation between the sleeve circuits or more than one Model TTS 39XB Output Amplifier Module connected to the start circuit of an associated Model TTS 39XF Frequency Cycling Adapter is provided by CR3. The supply

voltage is provided by voltage divider R14 and R15 and filter capacitor C5.

4.26 MODEL TTS 39XF FREQUENCY CYCLING ADAPTER.

4.27 The Model TTS 39XF Frequency Cycling Adapter consists of a basic rack mounting panel containing the terminals, wiring, time base and switching necessary to provide the cycling of up to ten frequencies in sequence.

4.28 When ground is applied to either of the start leads, relay SH operates. The start leads are connected to terminals 3 and 4 of TB1. Two seperate start circuits permit the cycling of either of two sequences, one having a greater number of frequencies thenthe other. The number of frequencies is determined by the strapping of switch wiper banks E and F of selector switch RM.

4.29 Relay SH operates and supplies battery to relay DF, removes ground from the homing circuit of RM and applies ground to the C wiper of RM. This causes RM to move from the home position to the first position. The current path from the battery through the coil of DF to the negative side of C1 is completed by the operation of SH. Relay DF operates as the charging current for C1 passes through its coil. However, when C1 has charged to the operating voltage of relay D, this series current path is broken and DF releases. Relay DF, while it is operated, supplies the step pulse to RM, causing RM to move one step. The next step pulse for RM will be applied at the release of relay D, which will again operate DF momentarily. This operation is repetitive until the start ground is removed.

4.30 The C wiper circuit of RM is employed to cause RM, when reaching its home position, to advance to its first position. This prevents the first frequency within the sequence from being transmitted twice for each revolution of RM. Normally, as shown in figure 7-5, the frequency that is associated with the first position of RM is also associated with the home position. This frequency switching is accomplished over the A and B banks of RM. When the Model TTS 39XF Frequency Cycling Adapter is associated with the Model TTS 39A or TTS 39B employing both multi and single frequency operation, the Model TTS 39XB Output Amplifier Module associated with the single frequency operation does not supply a start ground to the Model TTS 39XF. Thus, the frequency transmitted for single frequency operation will not be that of the first frequency transmitted in multi-frequency operation.

4.31 The function of the D bank of RM is to change the time interval of the frequencies to be transmitted. These time intervals are arranged so that approximately 10 seconds will be allowed for the first frequency and 5 seconds for the remaining frequencies. However, other time intervals can be supplied through the selection of the value of R101.

4.32 Pilot lamp DS1 is controlled by the ONC and RM contacts of RM. When RM is in the home position, the ONC contacts of RM complete a circuit from ground to DS1, causing it to light. When RM is not in the home position, DS1 will flash upon the operation of the RM contacts associated with the stepping mechanism. The diodes CR1 through CR4 provide isolation between the two start ground circuits.

4.33 When the start ground has been removed from the Model TTS 39XF stepping switch RM will be driven to its home position by the ground applied to its homing circuit upon the release of relay SH. It will not be advanced again until a new start ground is applied to the Model TTS 39XF.

4.34 The lead connecting terminal 12 of TB1 to the coil of relay RM is utilized for installations involving automatic programming of these units. The resistors identified as HI-Z and LOW-Z are the frequency determining resistors associated with the null network contained within the Model TTS 39A or TTS 39B oscillator. Thus, as these resistors are switched so is the frequency of the oscillator.

4.35 OPTIONS FOR THE MODEL TTS 39XB OUTPUT AMPLIFIER MODULE.

4.36 Option 1. As illustrated by figure 7-8, option 1 is comprised of the gas tube V1 which is attached across the tip and ring outputs of the Model TTS 39XB Output Amplifier Module. This gas tube appears as a high impedance across the tip and ring until it is fired by a ringing voltage. Once fired, the impedance of V1 decreases to represent an off hook condition which, in turn, discontinues the ringing voltage. Once the ringing voltage is discontinued, the impedance of V1 increases to its original high value and bridges the output of the Output Amplifier Module.

4.37 Option 2. As illustrated by figure 7-9, option 2 is comprised of hold coil L1 which is attached across the tip and ring outputs of the Model TTS 39XB Output Amplifier Module. This inductor trips the ringing and provides a hold circuit on the output of the Output Amplifier Module.

4.38 Option 3. As illustrated by figure 7-10, option 3 is comprised of a hold coil, two relays, a steering diode and two dropping resistors. Inductor L1 trips the ringing and provides a hold circuit on the output of the Output Amplifier Module. Relay K2 provides a start ground for the time cycle generator circuit contained within the Model TTS 39B upon the application of ground to the sleeve terminal of Output Amplifier Module. Relay K1, in conjunction with the time cycle generator circuit, provides regular interruptions of the output signal that represent on and off hook cycling.

4.39 Option 4. As illustrated by figure 7-11, option 4 is comprised of a steering diode, a relay and a dropping resistor. Relay K1 provides the start ground for the Model TTS 39XF Frequency Cycling Adapter upon the application of ground to the sleeve terminal of the Output Amplifier Module.

4.40 Option 5. Option 5 is comprised of the combination of option 1 and option 4.

4.41 Option 6. Option 6 is comprised of the combination of option 2 and option 4.

4.42 Option 7. As illustrated by figure 7-12, option 7 is comprised of a relay, two resistors, a coupling capacitor and a steering diode. Prior to the application of ground to the sleeve terminal of the Output Amplifier Module, the reference tone is terminated by R2 through the break contacts of K1 and the coupling capacitor C1. This termination is switched out and the reference tone routed directly to the tip and ring circuits by relay K1 when ground is applied to the sleeve terminal of the Output Amplifier Module in coincidence with a first position contact of stepping switch RM, contained within the Model TTS 39XF. Once this relay operation takes place, K1 receives power through its own make contacts and will remain operated until the ground is removed from the sleeve terminal of the Output Amplifier Module. Steering diode CR1 prevents the premature operation of relays contained in other Output Amplifier Modules attached to the same Model TTS 39XF.

4.43 Option 8. As illustrated by figure 7-13, option 8 is comprised of a relay, a capacitor and a precision resistor. Once the cycling provided by the Model TTS 39XF ends, a ground potential is directed to K1, causing it to operate. When K1 operates the through connections to terminals 3 and 4 of the Model TTS 39XB are broken and precision termination resistor R4 is ac coupled across the tip and ring outputs of TB1 by C2.

4.44 Option 9. As illustrated by figure 7-14, option 9 is comprised of two steering diodes, three dropping resistors, a timing capacitor and two relays. Once the output of the Model TTS 39XB is seized, a ground potential appears on the sleeve lead operating K3. When K3 operates, a start ground is supplied to the Model TTS 39XF which begins to cycle. Each time the Model TTS 39XF steps to a new frequency a ground potential appears at the anode of CR2 causing C1 to discharge through R1. After a time, determined by the rc time constant of C1 and R1, K2 operates connecting L1 across the tip and ring outputs of the Model TTS 39XB. In this manner the repeated stepping of the Model TTS 39XF initiates on and off hook cycling in the output of the Model TTS 39XB.

4.45 TTS 39MK-1. As illustrated by figure 7-15, the MK-1 option is comprised of a dropping resistor, a relay and a timing capacitor. Once the output of the Model TTS 39XB is seized, a ground potential appears on the sleeve lead of TB1 causing C1 to discharge through R1. After a time determined by the rc time constant of R1 and C1, K1 operates applying the output signal across the tip and ring leads of TB1.

# SECTION 5

## MAINTENANCE AND CALIBRATION

5.1 INTRODUCTION.

5.2 Paragraphs 5.3 through 5.9 in conjunction with figures 7-1 and 7-6 provide the calibration procedures for Models TTS 39A and TTS 39B. Paragraphs 5.10 through 5.14 provide the general maintenance instructions for the instruments discussed in this manual.

5.3 CALIBRATION.

5.4 The Models TTS 39A and TTS 39B may require a minimum calibration.

5.5 MODELS TTS 39A AND TTS 39B.

5.6 The only circuitry requiring calibration contained within the Model TTS 39A or TTS 39B is the oscillator. The following procedures are provided; an oscillator positive feedback adjustment and a thermistor operating level adjustment.

5.7 Oscillator Positive Feedback Adjustment. Adjust R15 until 1.5 volts rms is measured (by a VTVM) at point "A" on figure 7-6.

5.8 Thermistor Operating Level Adjustment. The following procedure is provided for the thermistor operating level adjustment:

a. Connect a VTVM to the emitter of Q6.

b. Connect a level meter to the OSC TEST jack (J1).

c. Adjust R19 fully clockwise.

d. Observe the level at the OSC TEST jack and slowly adjust R19 counter clockwise until the level no longer increases as R19 is turned. If necessary, repeat this procedure until this point is clearly defined.

e. Observe the reading on the VTVM at this point, the reading should be approximately 4 to 5 volts rms.

f. Continue adjusting R19 counter clockwise until the reading on the VTVM exceeds the reading noted in step e by 1 volt rms.

5.9 MAINTENANCE.

5.10 No routine maintenance is required for the instruments included in this manual apart from the occasional checks on output levels. However, some general statements should be made concerning the time cycle generator contained within the Model TTS 39B and the D relay contained within the Model TTS 39XF.

5.11 Should the time cycle generator contained within the Model TTS 39B fail to operate after the application of a start ground to the start terminal, the trouble will most likely be traced to dirty contacts. If the unit does not operate after cleaning the contacts of K1 and K2 the other components should be checked.

5.12 It should be noted that relay D, contained within the Model TTS 39XF, has been provided with a special adjustment. This adjustment consists of turning the break contact out to eliminate the air gap between the armature and the pole of the relay when operated. This delays the release, thus providing a much longer time constant than would otherwise be realized.

5.13 Should any of the equipment fail to operate, standard troubleshooting methods coupled with the information contained in the circuit description section of this manual and the critical voltage levels appearing on the schematics included in section 7 should facilitate their repair.

# SECTION 6

## ELECTRONIC PARTS LIST

6.1 INTRODUCTION. The following pages contain the parts list and component location diagrams of the Models TTS 39A, TTS 39B, TTS 39D, TTS 39XB and TTS 39XF.

6.2 FSCM Code Numbers. The Federal Supply Code of Manufacturers as issued October 1971. A list of codes and their respective manufacturers is given below in Table 6-1.

Table 6-1. List of Manufacturers

| Code No. | Manufacturer |
|---|---|
| 00124 | Veco Instruments Inc., Plainview, L.I., New York 11803 |
| 01121 | Allen Bradley, Milwaukee, Wis. 53204 |
| 01295 | Texas Instrument Inc., Dallas, Texas 75231 |
| 04009 | Arrow-Hart and Hegeman, Hartford, Conn. 06106 |
| 04221 | Midtex Inc., Mankato, Minn. 56001 |
| 04773 | Automatic Electric Co., Northlake, Ill. 60164 |
| 06486 | IRC Division of TRW, Lynn, Mass. 01905 |
| 09353 | IEI, Brooklyn, N.Y. |
| 12065 | Transitron Electronic Corp., Boston, Mass. 02128 |
| 12697 | Clarostat Mfg., Dover, N.H. 03820 |
| 13606 | Sprague Electric Co., Concord, N.H. 03301 |
| 19701 | Electra/Midlands, Mineral Wells, Texas 76067 |
| 22650 | Whale Electronics, Nashville, Tenn. |
| 27735 | F-DYNE Electric Co., Fairfield, Conn. 06430 |
| 31785 | Isotemp Research Inc., Charlottsville, Md. 22901 |
| 49956 | Raytheon Co., Lexington, Mass. 02173 |
| 71590 | Centralab, Milwaukee, Wis. 53201 |
| 71785 | Cinch Mfg. Co., Chicago, Ill. 60624 |
| 72136 | Electro Motive Mfg., Willimantic, Conn. 06226 |
| 72241 | Cetron Electronic Corp., Geneva, Ill. 60134 |
| 72619 | Dialight Corp., Brooklyn, N.Y. 11237 |
| 73869 | Herzog Minature Lamp Works Inc., New York, N.Y. |
| 75915 | Littelfuse Inc., Des Planes, Ill. 60016 |
| 77342 | Potter-Brumfield Sales Co., Chicago, Ill. |
| 77820 | Bendix Corp. Electrical Components, Sidney, N.Y. 13838 |
| 78277 | Sigma Instruments, Co. Braintree, Mass. 02185 |
| 80223 | United Transformer Co., New York, N.Y. 10013 |
| 80368 | Sylvania Electric Inc., New York, N.Y. 10017 |
| 82389 | Switchcraft Inc., Chicago, Ill. 60630 |
| 86632 | Newton Engineering, Newton, Mass. 02161 |

Table 6-2. TTS 39A/B Overall Parts List

| REFERENCE DESIGNATOR | DESCRIPTION VALUE POWER VOLT | MFGR. | MFGR. PART NO. | N. E. C. # |
|---|---|---|---|---|
| TTS 39A | E95026 | | | B003910010 |
| TTS 39B | E95035 | | | B056500010 |
| C1 | C: 0.01μF, 60V | 71590 | 1D-01 | 330101030 |
| CR1 | Diode | 12065 | 1N4004 | 560040040 |
| DS1 | Lamp | 80368 | 60A | 730000200 |
| F1 | Fuse | 75915 | 3AG | 863100400 |
| J1 | Jack | 82389 | L12B | 650100300 |
| R31 | R: 100Ω, 5%, 5W | 13606 | 243E1015 | 210401015 |
| R91 | R: 220Ω, 10%, 5W | 01121 | Type EB | 200202216 |
| S1 | Switch | 04009 | 81015-BP | 620100100 |
| TB1 | Terminal board 13 contact | 71785 | 13-140 $\frac{3}{4}$W | 850001000 |

TTS 39A/B Voltage Divider Board

| REFERENCE DESIGNATOR | DESCRIPTION VALUE POWER VOLT | MFGR. | MFGR. PART NO. | N. E. C. # |
|---|---|---|---|---|
| C10, 11 | C: 100μF, 10%, 50V | 13606 | TVA1310 | 300401070 |
| C12 | C: 20μF, 10%, 25V | 09353 | APD046 | 300902060 |
| R32 | R: 1.2K, 10%, 3W | 06486 | PW3 | 210301226 |
| R34 | R: 600Ω, 10%, 3W | 06486 | PW3 | 210306016 |
| R35 | R: 100Ω, 10%, 5W | 01121 | Type EB | 200201016 |

TTS 39A/B XTAL Oven

| | | | | |
|---|---|---|---|---|
| | 2K, 10% | 00124 | 32A-3 | 290102020 |
| | | 31785 | 26CS | 925000200 |

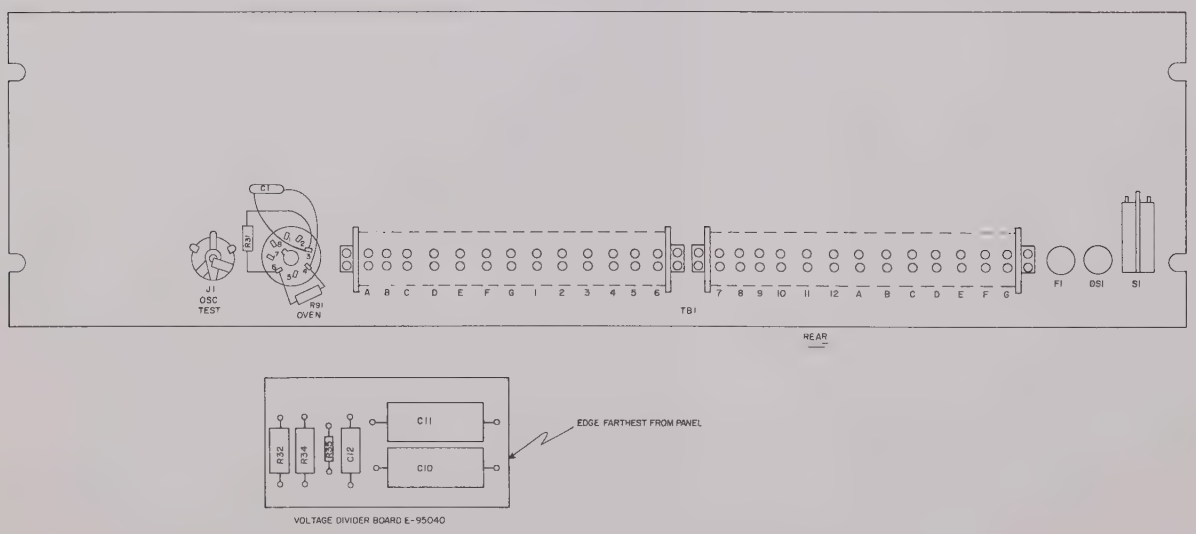






Figure 6-1. TTS 39A/B Overall Component Location

Table 6-3. TTS 39A/B Oscillator Amplifier

| REFERENCE DESIGNATOR | DESCRIPTION VALUE POWER VOLT | MFGR. | MFGR. PART NO. | E. N. C. # |
|---|---|---|---|---|
| C1-3 | C: 20μF, 10%, 25V | 09653 | APD046 | 300902060 |
| C4, 5 | C: 0.0096μF, 5%, 100V | 27735 | Type T | 321509620 |
| C6 | C: 20μF, 10%, 25V | 09653 | APD046 | 300902060 |
| C7 | C: 20μF, 10%, 50V | 13606 | TE1305 | 300202061 |
| C9 | C: 100μF, 10%, 50V | 09653 | APD127 | 300901072 |
| Q1-5 | Transistor | 01295 | 2N1375 | 553013750 |
| Q6 | Transistor | 77820 | 2N1136A | 553011351 |
| R13 | R: 220Ω, 10%, ½W | 01121 | Type EB | 200202216 |
| R14 | R: 47K, 10%, ½W | 01121 | Type EB | 200204736 |
| R15 | R: 400Ω, 10%, 2W | 12697 | CM22425NP | 230804010 |
| R17 | R: 3.3K, 5%, ½W | 01121 | Type EB | 200203325 |
| R18 | R: 220Ω, 10%, ½W | 01121 | Type EB | 200202216 |
| R19 | R: 400Ω, 10%, 2W | 12697 | CM22425NP | 230804010 |
| R20 | R: 1K, 10%, ½W | 01121 | Type EB | 200201026 |
| R21, 22 | R: 100K, 10%, ½W | 01121 | Type EB | 200201046 |
| R23 | R: 10K, 10%, ½W | 01121 | Type EB | 200201036 |
| R24 | R: 27K, 10%, ½W | 01121 | Type EB | 200202736 |
| R25 | R: 300K, 5%, ½W | 01121 | Type EB | 200203045 |
| R26 | R: 750Ω, 5%, ½W | 01121 | Type EB | 200207515 |
| R27 | R: 10K, 10%, ½W | 01121 | Type EB | 200201036 |
| R28 | R: 6.2K, 5%, ½W | 01121 | Type EB | 200206225 |
| R29 | R: 10K, 10%, ½W | 01121 | Type EB | 200201036 |
| R30 | R: 620Ω, 5%, ½W | 01121 | Type EB | 200206215 |
| R33 | R: 1K, 10%, 1W | 01121 | Type GB | 200301026 |
| R34 | R: 3.809, 5%, 5W | 19701 | MF5C | 220338017 |
| R35 | R: 57.39K, 5%, 5W | 19701 | MF5C | 220357327 |
| R89 | R: screw base | 73869 | NEC100 | 730100400 |
| R90 | R: 10K, 10%, ½W | 01121 | Type EB | 200201036 |

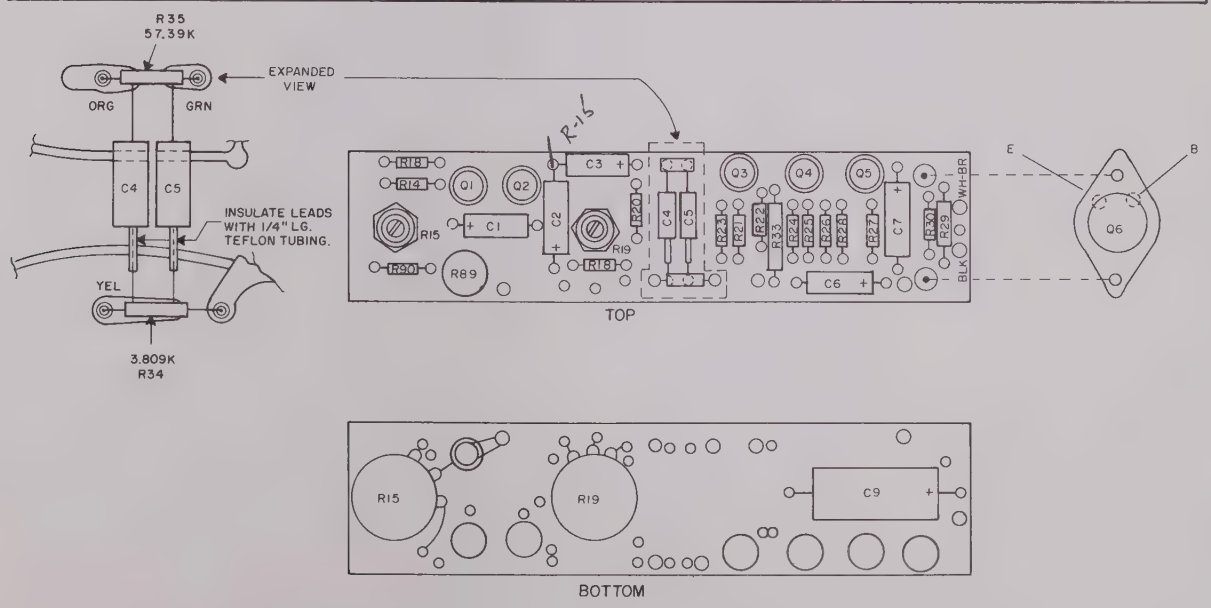
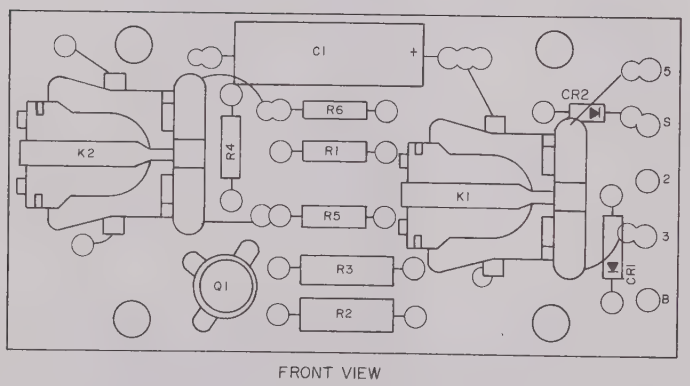



Figure 6-2. TTS 39A/B Oscillator Amplifier Component Location

Table 6-4. TTS 39B Time Cycle Generator Parts List

| REFERENCE DESIGNATOR | DESCRIPTION VALUE POWER VOLT | MFGR. | MFGR. PART NO. | N. E. C. # |
|---|---|---|---|---|
| C1 | C: 100μF,20V | 09653 | APD095 | 300901071 |
| CR1 | Diode | 12065 | 1N4004 | 560040040 |
| CR2 | Diode | 12065 | 1N769 | 562007690 |
| K1,2 | Relay, 10K,24V | 77342 | RS5D-24 | 604400300 |
| Q1 | Transistor | 01295 | 2N1375 | 553013750 |
| R1 | R: 5.1K,5%,½W | 01121 | Type EB | 200205125 |
| R2 | R: 1.8K,5%,1W | 01121 | GB | 200701825 |
| R3 | R: 1.2K,10%,1W | 01121 | Type GB | 200301226 |
| R4 | R: 2.2K,5%,½W | 01121 | Type EB | 200202225 |
| R5,6 | R: sel val, 5%,½W | 01121 | Type EB | 200200000 |




FRONT VIEW

Figure 6-3. TTS 39B Time Cycle Generator Component Location

Table 6-5. TTS 39D Overall Parts List

| REFERENCE DESIGNATOR | DESCRIPTION VALUE POWER VOLT | MFGR. | MFGR. PART NO. | N. E. C. # |
|---|---|---|---|---|
| CR1 | Diode | 12065 | 1N4004 | 560040040 |
| DS1 | Lamp | 80368 | 60A | 730000200 |
| F1 | Fuse | 75915 | 3AG | 863100400 |
| J1,2 | Jack | 82389 | 12B | 650101000 |
| S1 | Switch | 04009 | 81015-BP | 620100100 |
| TB1 | Terminal board 21 contact | 71785 | 21-140 $\frac{3}{4}$W | 850001700 |

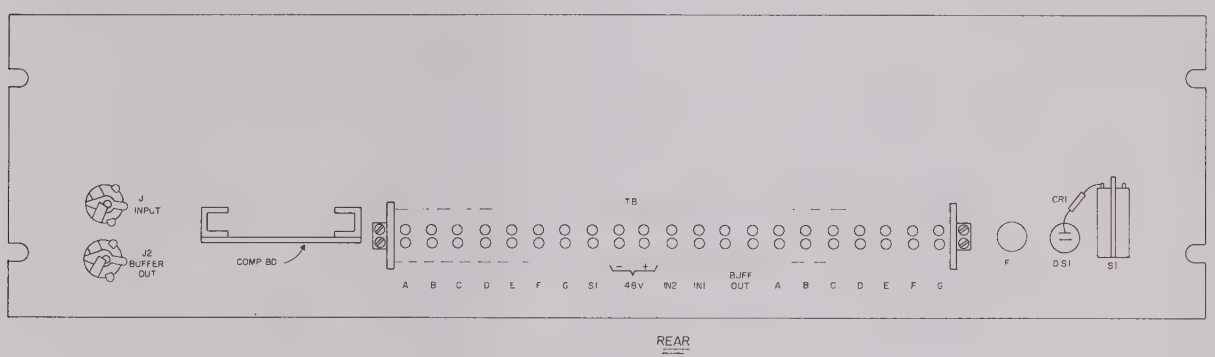



Figure 6-4. TTS 39D Overall Component Location

Table 6-6. TTS 39D Buffer Amplifier Parts List

| REFERENCE DESIGNATOR | DESCRIPTION VALUE POWER VOLT | MFGR. | MFGR. PART NO. | N. E. C. # |
|---|---|---|---|---|
| C1 | C: 100μF,10%,50V | 13606 | TVA1310 | 300401070 |
| C2,3 | C: 20μF,10%,25V | 09653 | APD046 | 300902060 |
| Q1 | Transistor | 01295 | 2N1274 | 553013740 |
| R1 | R: 1K,10%,3W | 09653 | PW3 | 210301026 |
| R2 | R: 1.2K,10%,3W | 09653 | PW3 | 210301226 |
| R3 | R: 100K,10%,5W | 01121 | Type EB | 200201046 |
| R4 | R: 9.1K,5%,5W | 01121 | Type EB | 200209125 |
| R5 | R: 4.7K,10%,5W | 01121 | Ttpe EB | 200204726 |

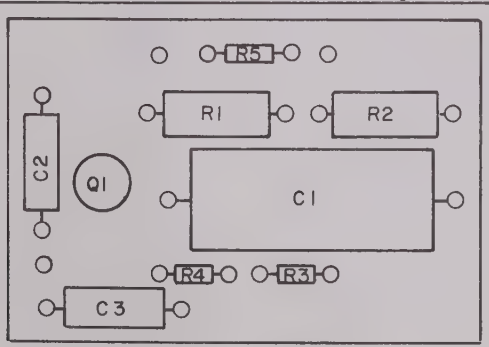



Figure 6-5. TTS 39D Buffer Amplifier Component Location

Table 6-7. TTS 39XB Overall Parts List

| REFERENCE DESIGNATOR | DESCRIPTION VALUE POWER VOLT | MFGR. | MFGR. PART NO. | N. E. C. # |
|---|---|---|---|---|
| C1 | C: 20μF, 10%, 25V | 09653 | APD046 | 300902060 |
| C2 | C: 5μF, 10%, 50V | 13606 | TE1303 | 300205051 |
| C3 | C: 20μF, 10%, 25V | 09653 | APD046 | 300902060 |
| C4 | C: 50μF, 10%, 75V | 22650 | 32-500-50-75-8NA | 301305061 |
| C5 | C: 100μF, 10%, 50V | 09653 | APD127 | 300901072 |
| C6 | C: 0.001μF, 10%, 125V | 13606 | 5GA-D10 | 330401020 |
| CR1,2 | Diode | 80368 | 1N38BS | 561000382 |
| J1 | Jack | 82389 | 54SF | 650200400 |
| Q1-3 | Transistor | 01295 | 2N1375 | 553013750 |
| R1 | R: 3.9K, 5%, 5W | 01121 | Type EB | 200203925 |
| R2 | R: 220K, 10%, 5W | 01121 | Type EB | 200202246 |
| R3 | R: 5K, 10%, 2W | 12697 | CM29064NP | 230805020 |
| R4 | R: 4.7K, 5%, 5W | 01121 | Type EB | 200204725 |
| R5 | R: 10K, 5%, 5W | 01121 | Type EB | 200201035 |
| R6 | R: 4.7K, 5%, 5W | 01121 | Type EB | 200204725 |
| R7 | R: 470K, 10%, 5W | 01121 | Type EB | 200204746 |
| R8 | R: 820Ω, 10%, 5W | 01121 | Type EB | 200208216 |
| R9 | R: 10K, 5%, 5W | 01121 | Type EB | 200201035 |
| R10 | R: 2.2K, 5%, 5W | 01121 | Type EB | 200202225 |
| R11 | R: 10K, 5%, 5W | 01121 | Type EB | 200201035 |
| R12 | R: 493Ω, 10%, 5W | 19701 | MF5C | 220249301 |
| R13 | R: 307Ω, 10%, 5W | 19701 | MF5C | 220230701 |
| R14 | R: 1.2K, 10%, 3W | 06486 | PW3 | 210301226 |
| R15 | R: 900Ω, 10%, 3W | 06486 | PW3 | 210309016 |
| R16 | R: 1.2K, 10%, 3W | 06486 | PW3 | 210301226 |
| R17 | R: 5K, 10%, 2W | 12697 | CM29064NP | 230805020 |
| R17A | R: 2.2K, 5%, $\frac{1}{2}$W | 01121 | Type EB | 200202225 |
| T1 | Transformer | 80223 | 5702A | 400300300 |
| TB1 | Terminal board 8 contact | 71785 | 8-140 $\frac{3}{4}$W | 850000600 |

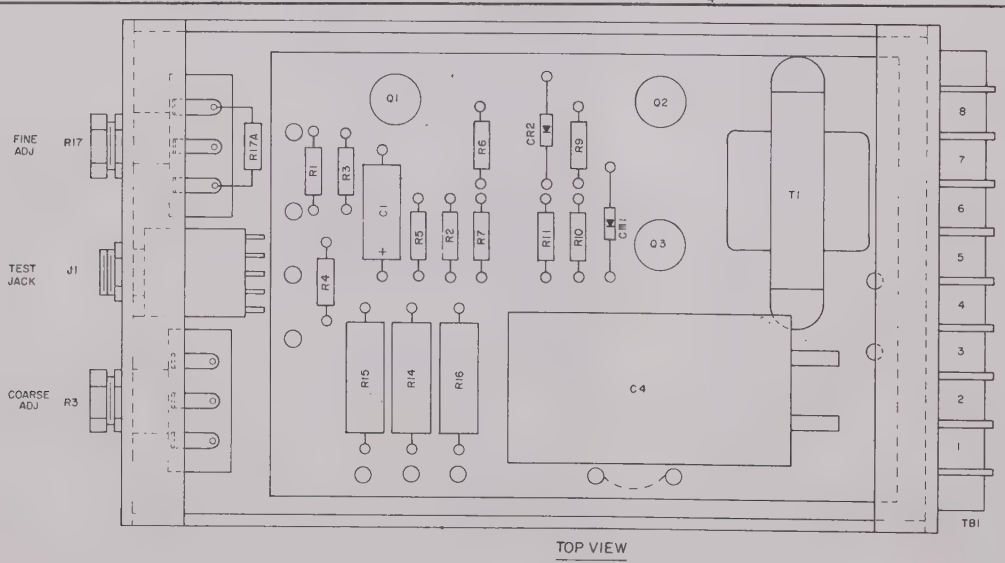



Figure 6-6. TTS 39XB Overall Component Location

Table 6-8. TTS 39XF Overall Parts List

| REFERENCE DESIGNATOR | DESCRIPTION VALUE POWER VOLT | MFGR. | MFGR. PART NO. | N. E. C. # |
|---|---|---|---|---|
| C1,2 | C: 200μF,10%,50V | 09653 | APS217 | 301002070 |
| CR1-4 | Diodes | 12065 | 1N4004 | 560040040 |
| D | Relay, 12K,2mA | 78277 | 4R-12000LG-SIL | 604500100 |
| DF | Relay, 0.5K,0mA | 78277 | 42R0500GSIL | 604600100 |
| DS1 | Lamp | 80368 | 60A | 730000200 |
| R1 | R: 12K,10%, $\frac{1}{2}$W | 01121 | Type EB | 200201236 |
| R2 | R: 1.2K,10%,3W | 06486 | PW3 | 210301226 |
| R3 | R: sel val, 10%, $\frac{1}{2}$W | 01121 | Type EB | 200200000 |
| S1 | Switch | 04773 | PW-56778-1 | 615100200 |
| SH | Relay, 0.5K,0mA | 78277 | 42R0500GSIL | 604600100 |
| TB1 | Terminal board 12 contact | 71785 | 12-140 $\frac{3}{4}$W | 850000900 |

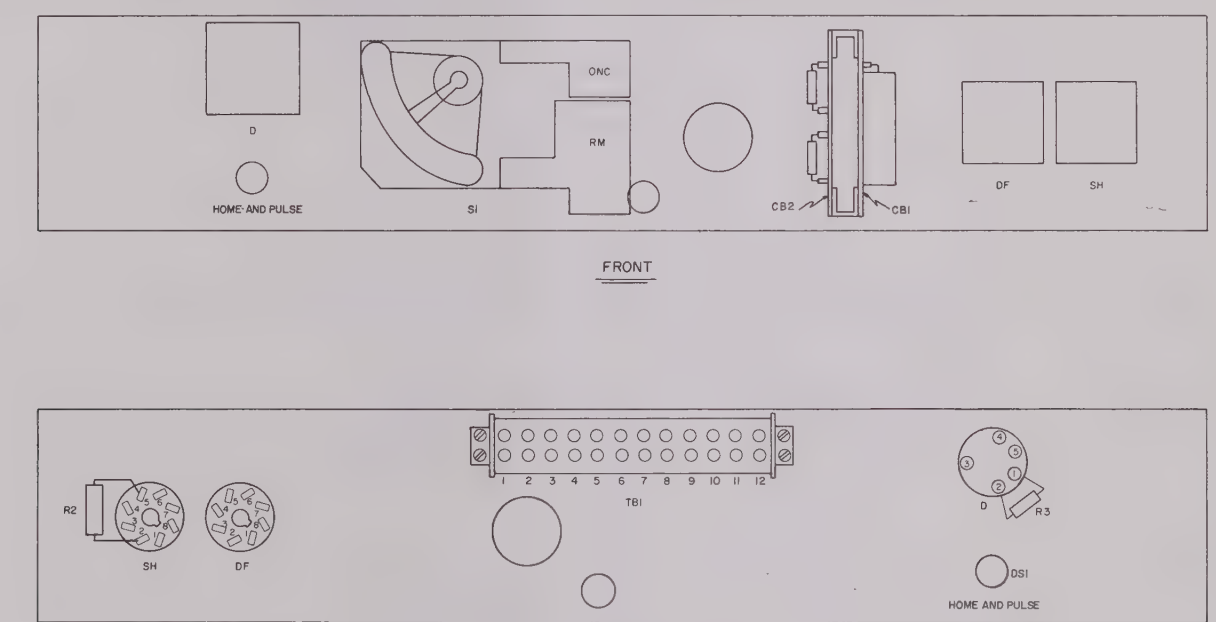



Figure 6-7. TTS 39XF Overall Component Location

Table 6-9. TTS 39XB Option 1 Parts List

| REFERENCE DESIGNATOR | DESCRIPTION VALUE POWER VOLT | MFGR. | MFGR. PART NO. | N. E. C. # |
|---|---|---|---|---|
| V1 | Varistor | 72241 | 353A | 710100300 |

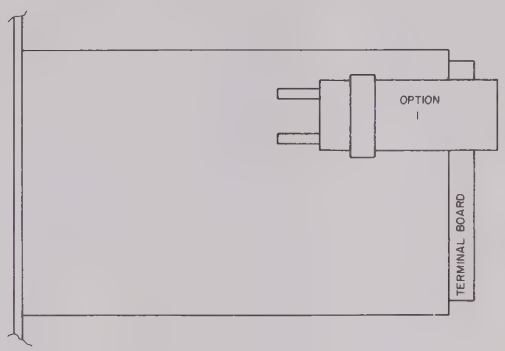



Figure 6-8. TTS 39XB Option 1 Component Location

Table 6-10. TTS 39XB Option 2 Parts List

| REFERENCE DESIGNATOR | DESCRIPTION VALUE POWER VOLT | MFGR. | MFGR. PART NO. | N. E. C. # |
|---|---|---|---|---|
| L1 | Inductor | 86632 | TN-1274 | 450200200 |

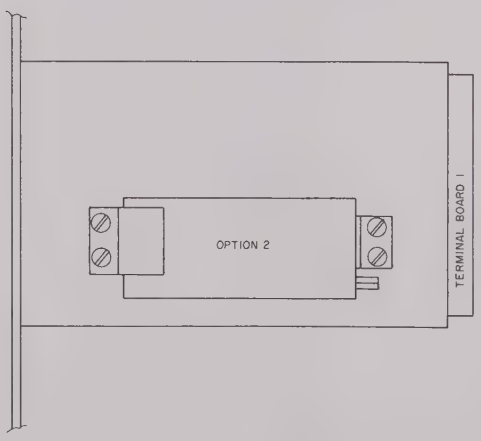



Figure 6-9. TTS 39XB Option 2 Component Location

Table 6-11. TTS 39XB Option 3 Parts List

| REFERENCE DESIGNATOR | DESCRIPTION VALUE POWER VOLT | MFGR. | MFGR. PART NO. | N. E. C. # |
|---|---|---|---|---|
| CR1 | Diode | 12065 | 1N4004 | 560040040 |
| K1,2 | Relay | 77342 | RS5D-24 | 604400300 |
| R4,6 | R: 4.7K,10%,5W | 01121 | Type EB | 200204726 |

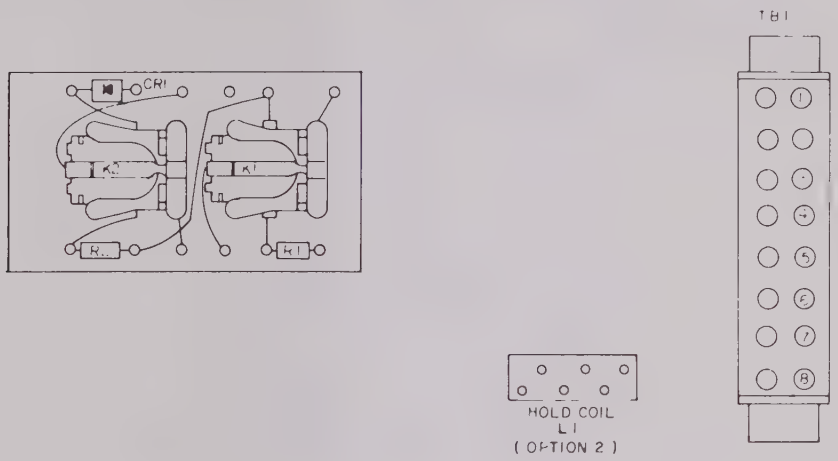



Figure 6-10. TTS 39XB Option 3 Component Location

Table 6-12. TTS 39XB Option 4 Parts List

| REFERENCE DESIGNATOR | DESCRIPTION VALUE POWER VOLT | MFGR. | MFGR. PART NO. | N. E. C. # |
|---|---|---|---|---|
| CR1 | Diode | 12065 | 1N4004 | 560040040 |
| K1 | Relay, 10K,24V | 77342 | RS5D-24 | 604400300 |
| R1 | R: 2K,5%,5W | 01121 | Type EB | 200202025 |

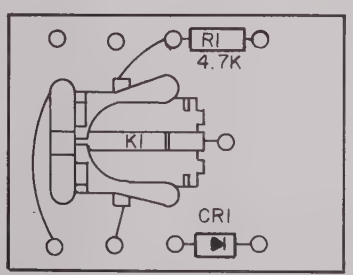



Figure 6-11. TTS 39XB Option 4 Component Location

Table 6-13. TTS 39XB Option 7 Parts List

| REFERENCE DESIGANTOR | DESCRIPTION VALUE POWER VOLT | MFGR. | MFGR. PART NO. | N. E. C. # |
|---|---|---|---|---|
| C1 | C: 2μF, 10%, 200V | 27735 | D-2.0-200-10 | 301302050 |
| CR1 | Diode | 12065 | 1N4004 | 560040040 |
| K1 | Relay, 2.6K, 10%, 48V | 04221 | 156-14D100 | 604100100 |
| R1 | R: 1.2K, 10%, 3W | 06486 | PW3 | 210301226 |
| R2 | R: 900Ω, 1%, 1/8W | 19701 | MF5C | 220290001 |

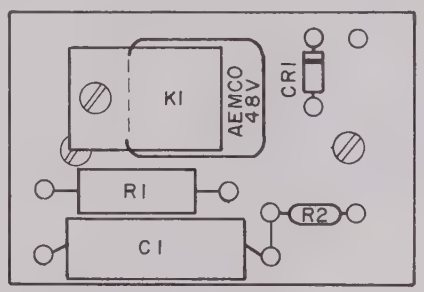



Table 6-12. TTS 39XB Option 7 Component Location

Table 6-14. TTS 39XB Option 8 Parts List

| REFERENCE GENERATOR | DESCRIPTION VALUE POWER VOLT | MFGR. | MFGR. PART NO. | N. E. C. # |
|---|---|---|---|---|
| C2 | C: 2μF, 10%, 200V | 27735 | D-2.0-200-10 | 301302050 |
| K1 | Relay | 04221 | 181-12D-200 | 604101400 |
| R4 | R: 900Ω, 10%, ½W | 19701 | MF5C | 220290001 |

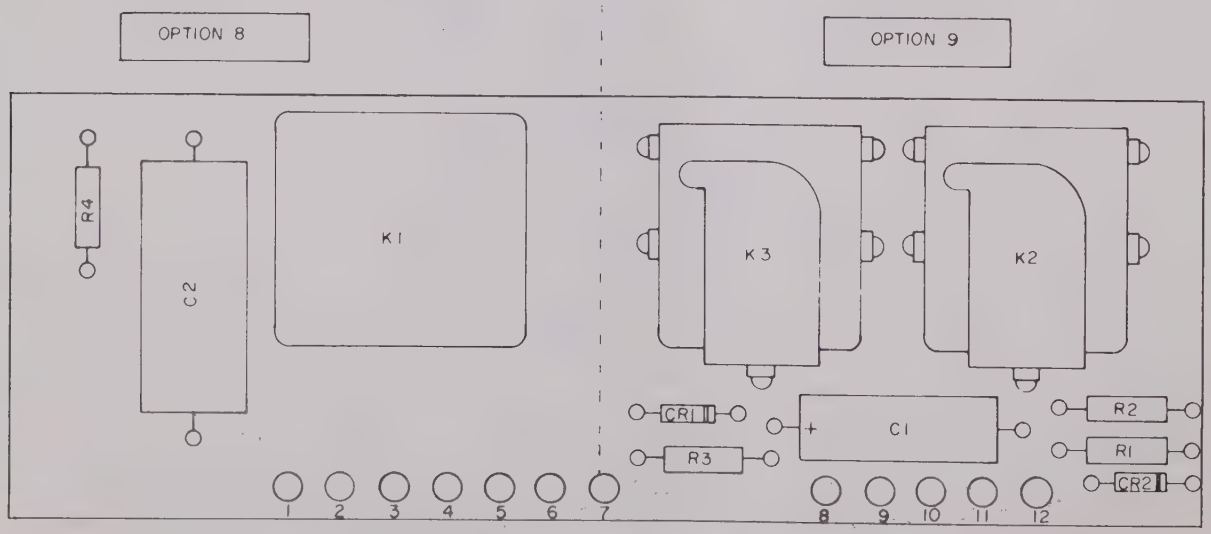



Figure 6-13. TTS 39XB Options 8 and 9 Component Location

Table 6-15. TTS 39XB Option 9 Parts List

| REFERENCE DESIGNATOR | DESCRIPTION VALUE POWER VOLT | MFGR. | MFGR. PART NO. | N. E. C. # |
|---|---|---|---|---|
| C1 | C: 50μF, 10%, 25V | 13606 | TVA-1206 | 300405062 |
| CR1,2 | Diode | 12065 | 1N4004 | 560040030 |
| K2,3 | Relay, 6.5K, 24V | 78277 | 65FP1A-24 | 604300300 |
| R1 | R: 100Ω, 10%, ½W | 01121 | Type EB | 200201016 |
| R2,3 | R: 5.6K, 5%, ½W | 01121 | Type EB | 200205625 |

Table 6-16. TTS 39XB MK-1 Option Parts List

| REFERENCE DESIGNATOR | DESCRIPTION VALUE POWER VOLT | MFGR. | MFGR. PART NO. | N. E. C. # |
|---|---|---|---|---|
| C1 | C: 200μF, 10%, 50V | 09653 | APS217 | 301002070 |
| K1 | Relay, 2.5K, 24V | 77342 | RS5D-24 | 604400300 |
| R1 | R: sel val | 01121 | EB | 200200000 |

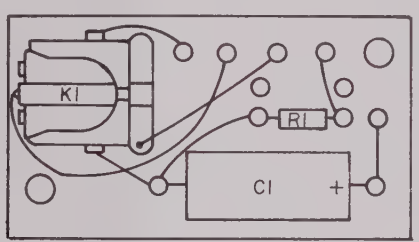



Figure 6-14. TTS 39XB MK-1 Option Component Location

# SECTION 7

# SCHEMATIC DIAGRAMS

7.1 INTRODUCTION.

7.2 The following pages contain the schematic diagrams of the Models TTS 39A, TTS 39B, TTS 39D, TTS 39XB and TTS 39XF.

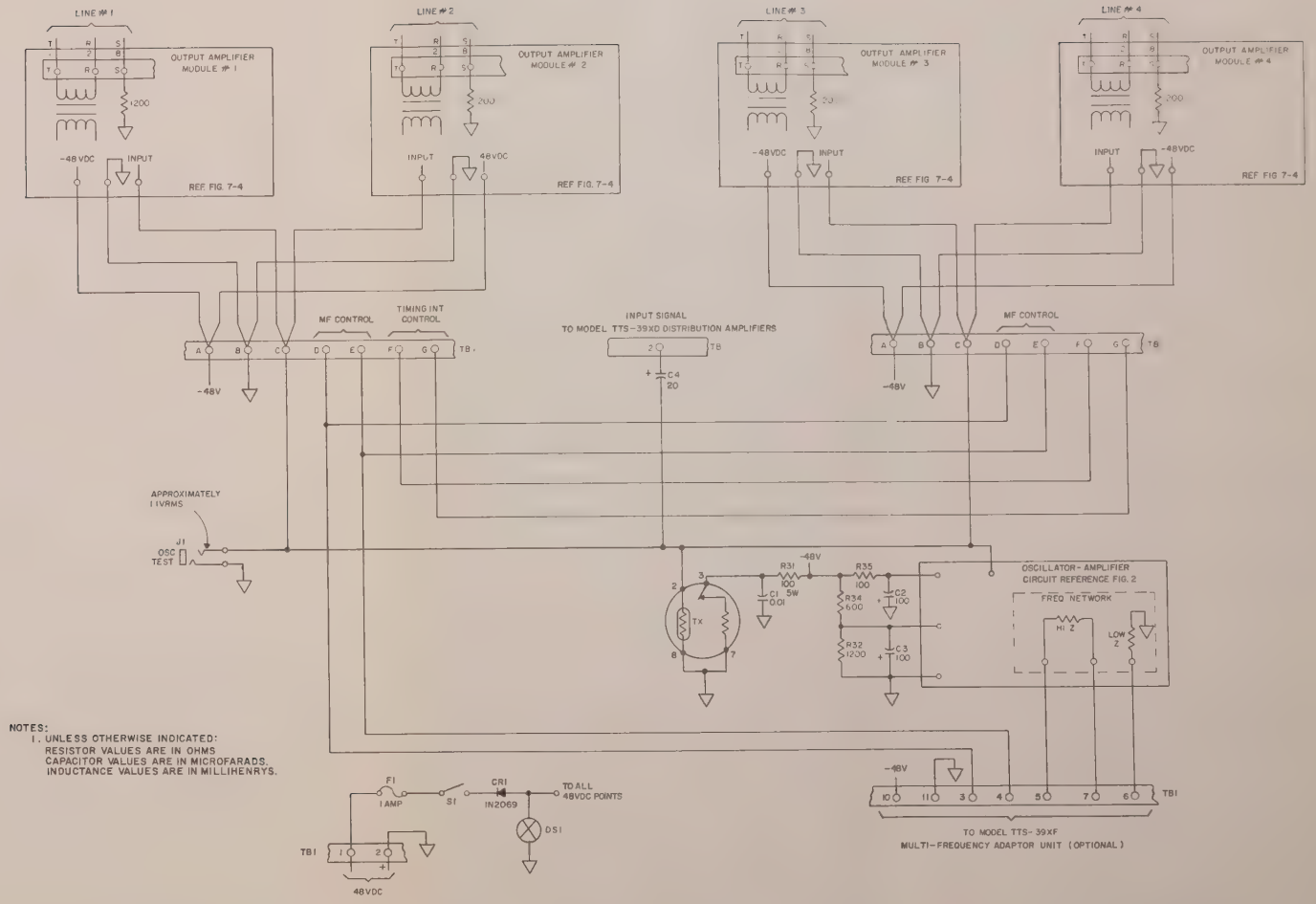
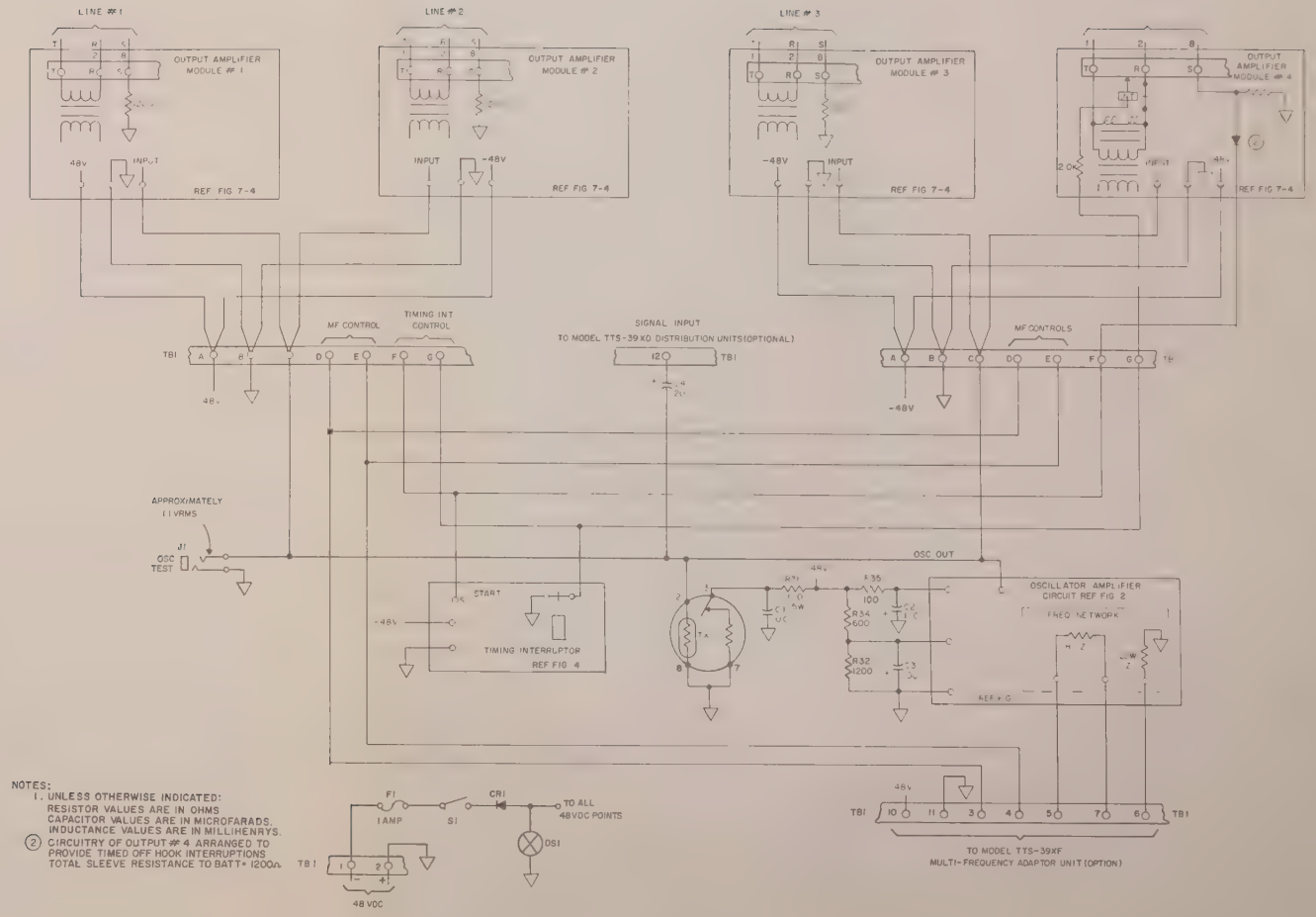



Figure 7-1. TTS 39A Overall Schematic Diagram




NOTES:
1. UNLESS OTHERWISE INDICATED:
   RESISTOR VALUES ARE IN OHMS
   CAPACITOR VALUES ARE IN MICROFARADS.
   INDUCTANCE VALUES ARE IN MILLIHENRYS.
2. CIRCUITRY OF OUTPUT # 4 ARRANGED TO PROVIDE TIMED OFF HOOK INTERRUPTIONS TOTAL SLEEVE RESISTANCE TO BATT = 1200Ω

Figure 7-2. TTS 39B Overall Schematic Diagram

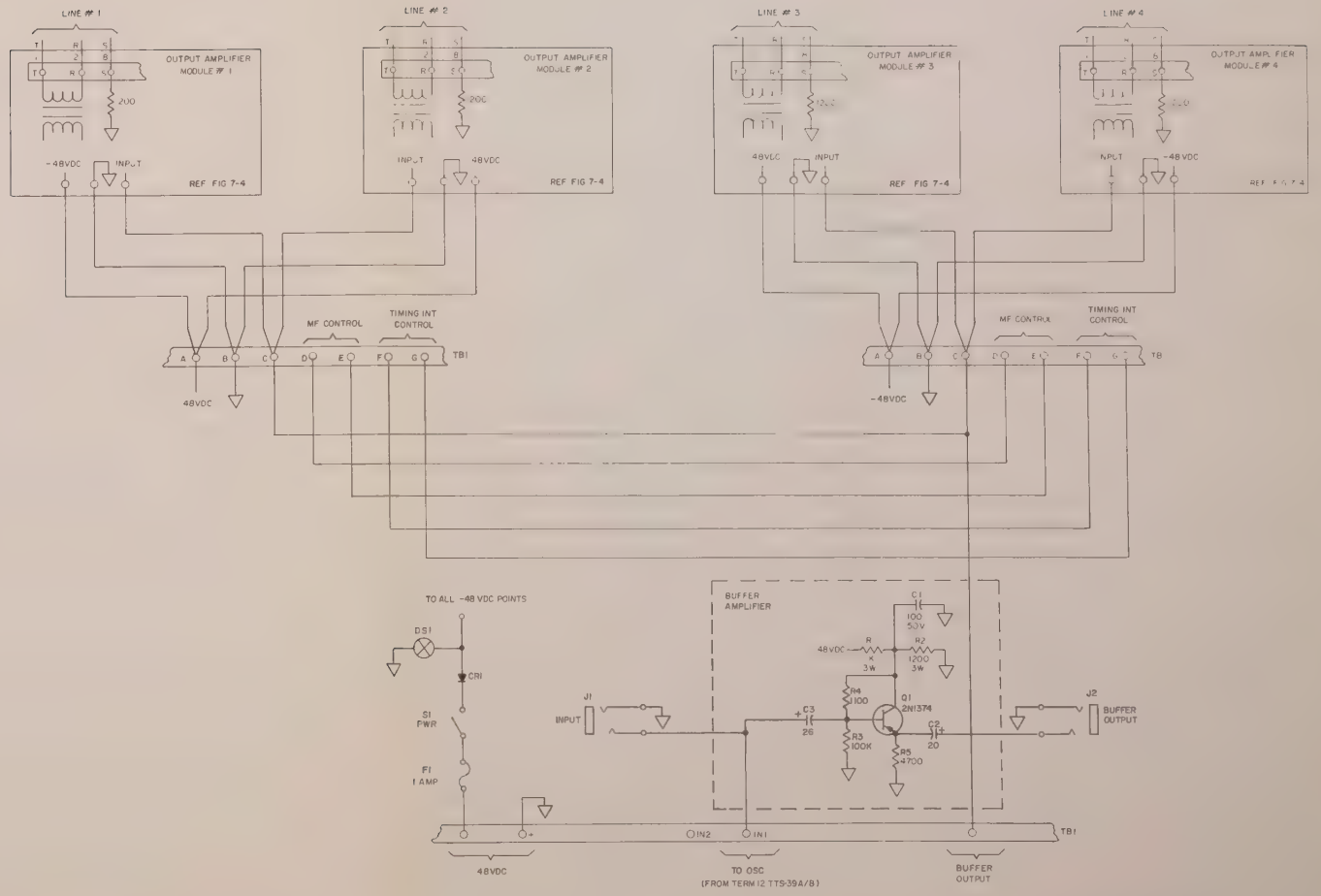
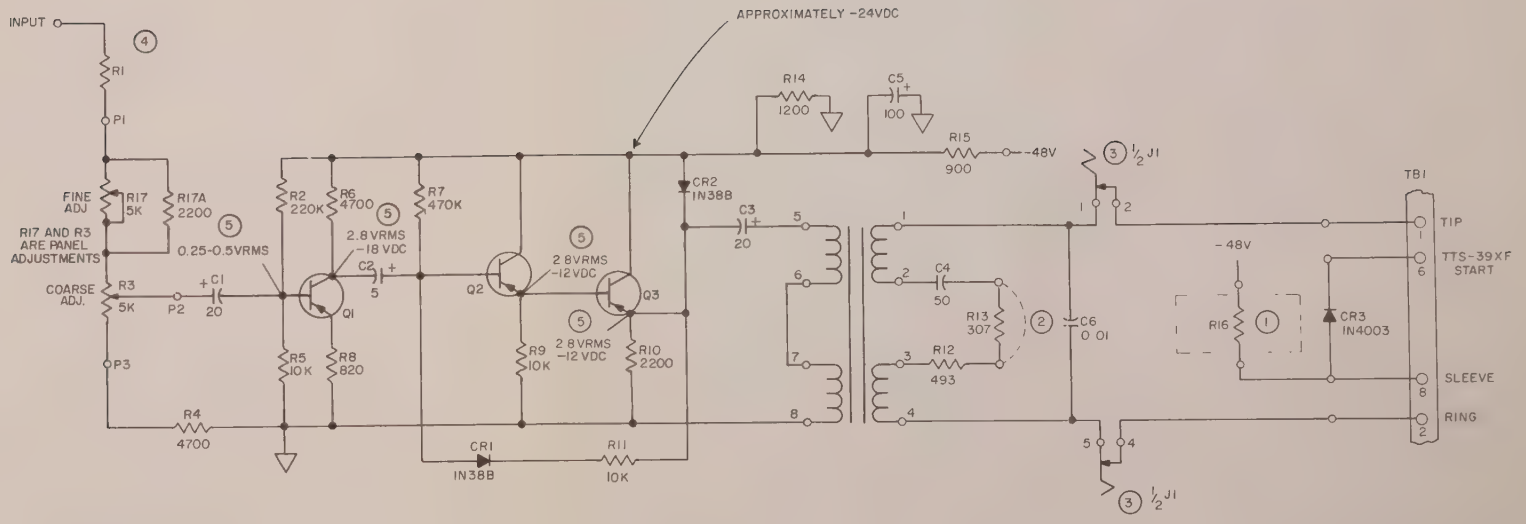



Figure 7-3. TTS 39D Overall Schematic Diagram




NOTES:

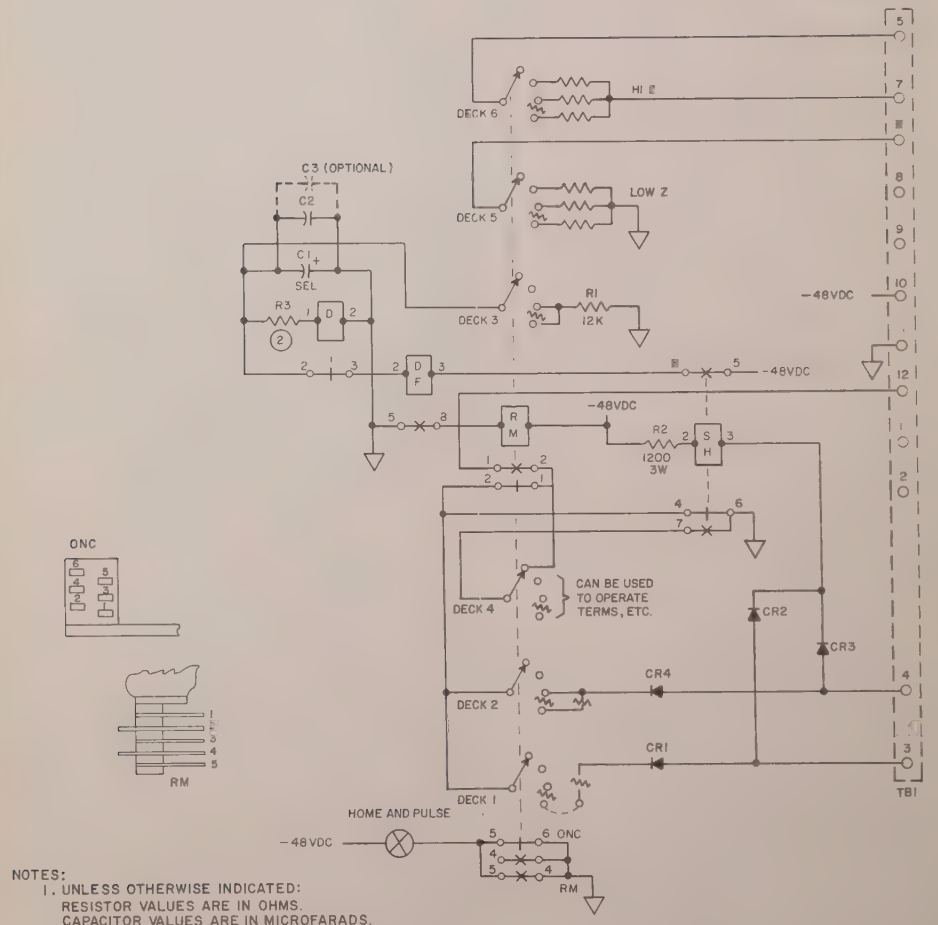
1. UNLESS OTHERWISE INDICATED:
   RESISTOR VALUES ARE IN OHMS.
   CAPACITOR VALUES ARE IN MICROFARADS.
   INDUCTANCE VALUES ARE IN MILLIHENRYS.
2. (1) SLEEVE RESISTANCE NORMALLY SUPPLIED = 1200Ω
3. (2) INSERT STRAP FOR 600Ω, REMOVE FOR 900Ω
4. (3) TEST JACK
5. (4) SELECTED VALUE TO PROVIDE DESIRED OUTPUT RANGE
6. (5) RMS VOLTAGES MEASURED WITHOUT FINAL OUTPUT LOADED

APPROXIMATE D.C. RESISTANCES OF T1

| | |
|---|---|
| TERM. 5 TO TERM. 8 | 40Ω-60Ω |
| TERM. 1 TO TERM. 2 | 20Ω-30Ω |
| TERM. 3 TO TERM. 4 | 20Ω-30Ω |

TROUBLE SHOOTING AID

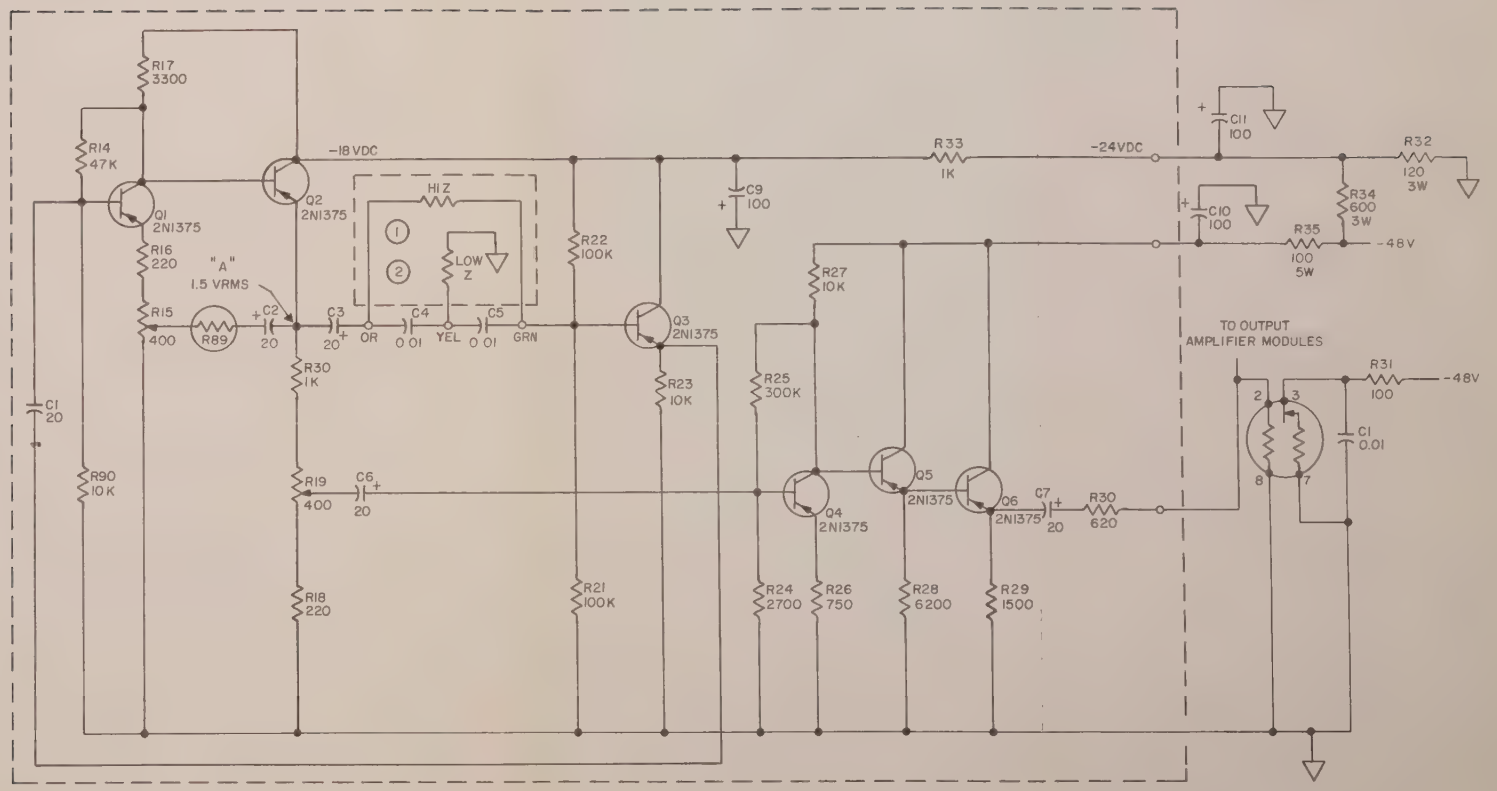
Figure 7-4. TTS 39XB Schematic Diagram




NOTES:
1. UNLESS OTHERWISE INDICATED:
   RESISTOR VALUES ARE IN OHMS.
   CAPACITOR VALUES ARE IN MICROFARADS.
   INDUCTANCE VALUES ARE IN MILLIHENRYS.

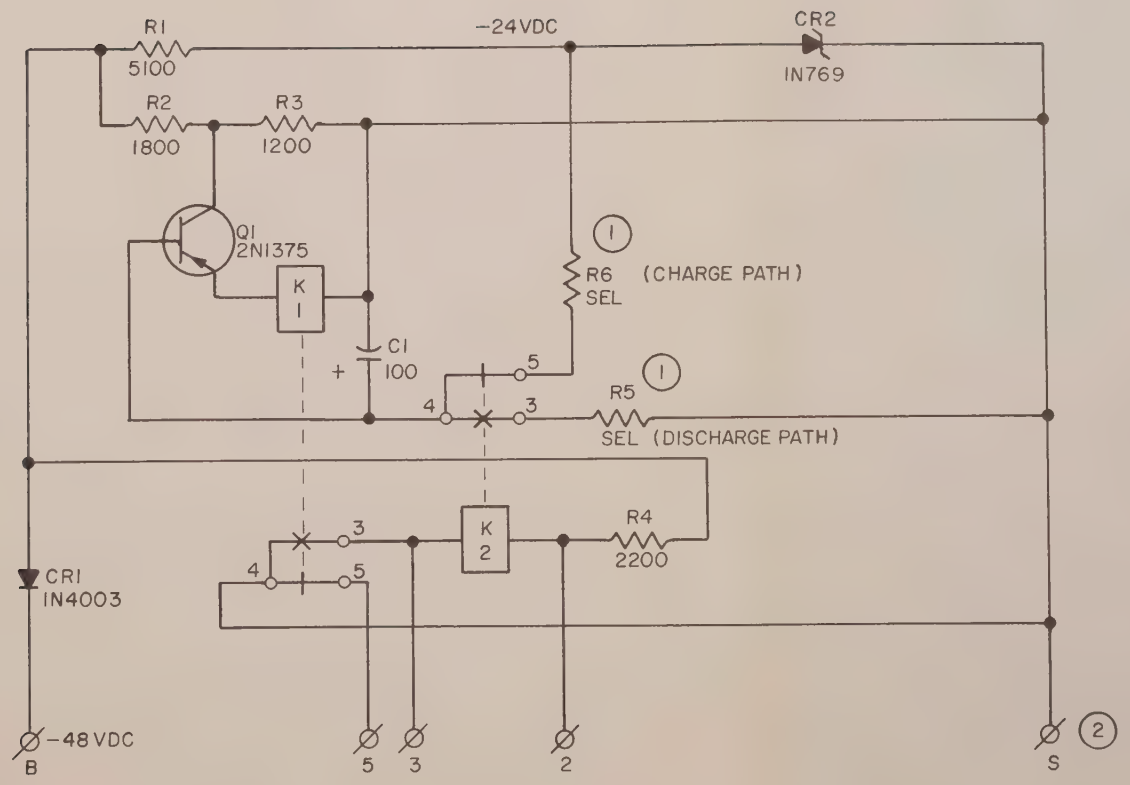
(2) SELECTED VALUE DECK I NEAREST TO PANEL

Figure 7-5. TTS 39XF Schematic Diagram




NOTES:
1. UNLESS OTHERWISE INDICATED:
   RESISTOR VALUES ARE IN OHMS.
   CAPACITOR VALUES ARE IN MICROFARADS.
   INDUCTANCE VALUES ARE IN MILLIHENRYS.
(1) SELECTED VALUES TO PROVIDE DESIRED FREQUENCY
(2) OMIT FOR MUTI-FREQUENCY OPERATION

Figure 7-6. TTS 39A/B Oscillator Amplifier Schematic Diagram

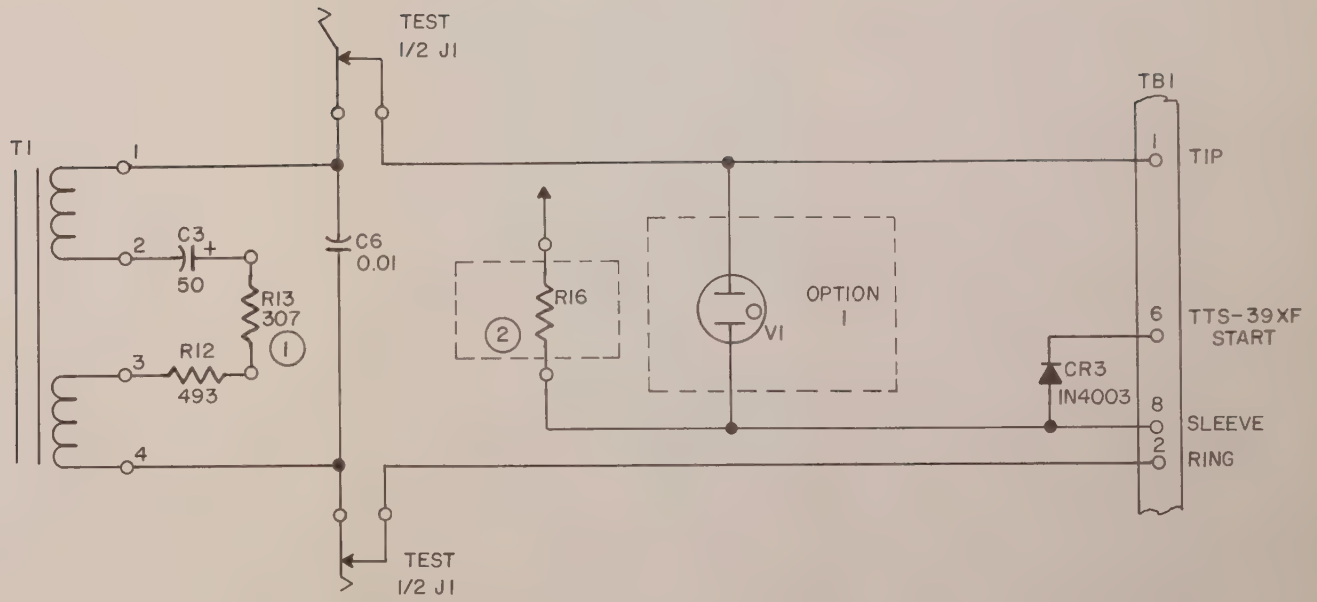



NOTES;

(1) SELECTED TO PROVIDE DESIRED TIMMING.

(2) TO START APPLY GROUND TO TERM "S"

Figure 7-7. TTS 39B Time Cycle Generator Schematic Diagram

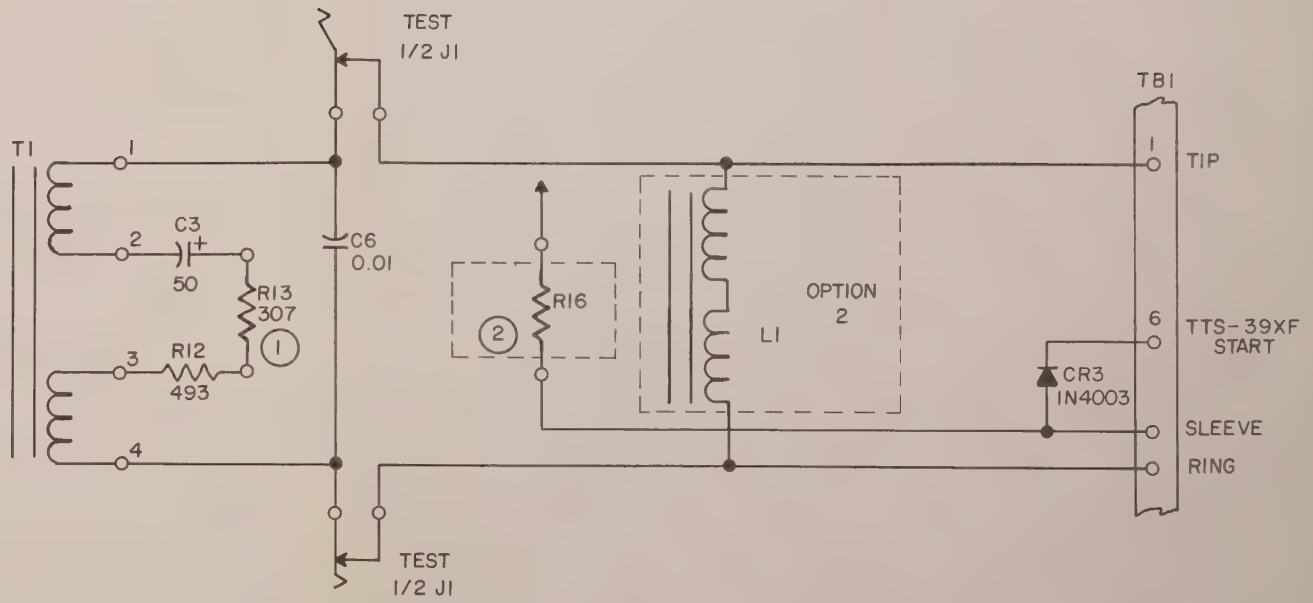



NOTES,

(1) R13 CAN BE SHORTENED TO PROVIDE AN OUTPUT IMPEDANCE OF 600Ω.

(2) R16 NORMALLY PROVIDES A SLEEVE RESISTANCE OF 1200Ω.

Figure 7-8. TTS 39XB Option 1
Schematic Diagram

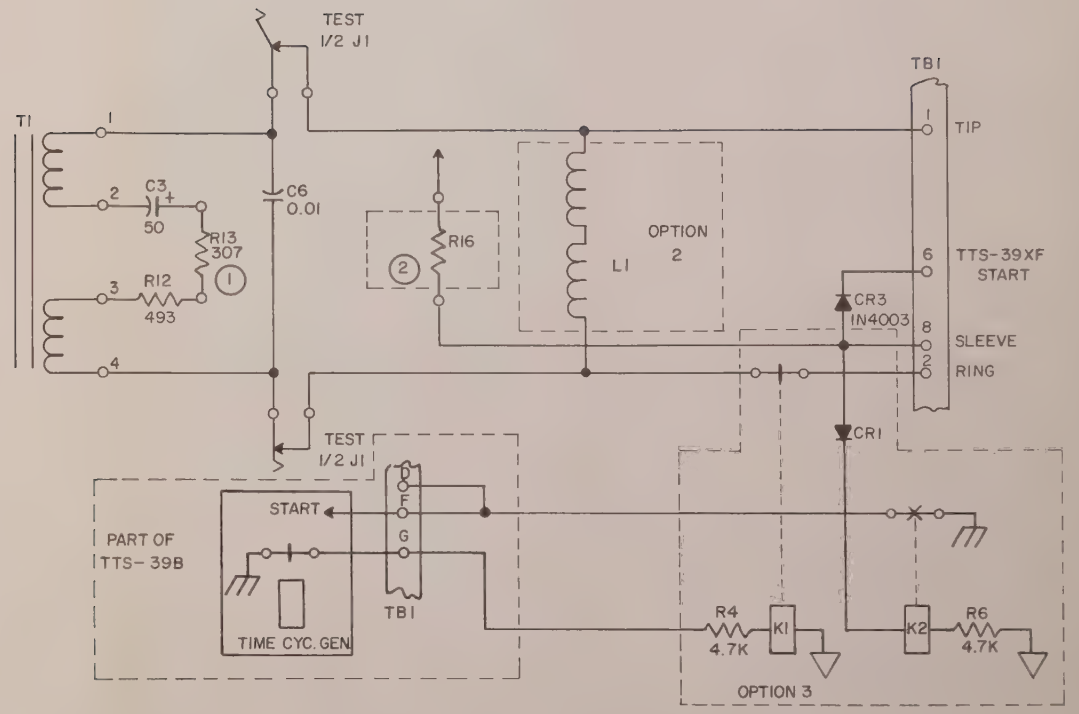



NOTES,

(1) R13 CAN BE SHORTENED TO PROVIDE AN OUTPUT IMPEDANCE OF 600Ω

(2) R16 NORMALLY PROVIDES A SLEEVE RESISTANCE OF 1200Ω

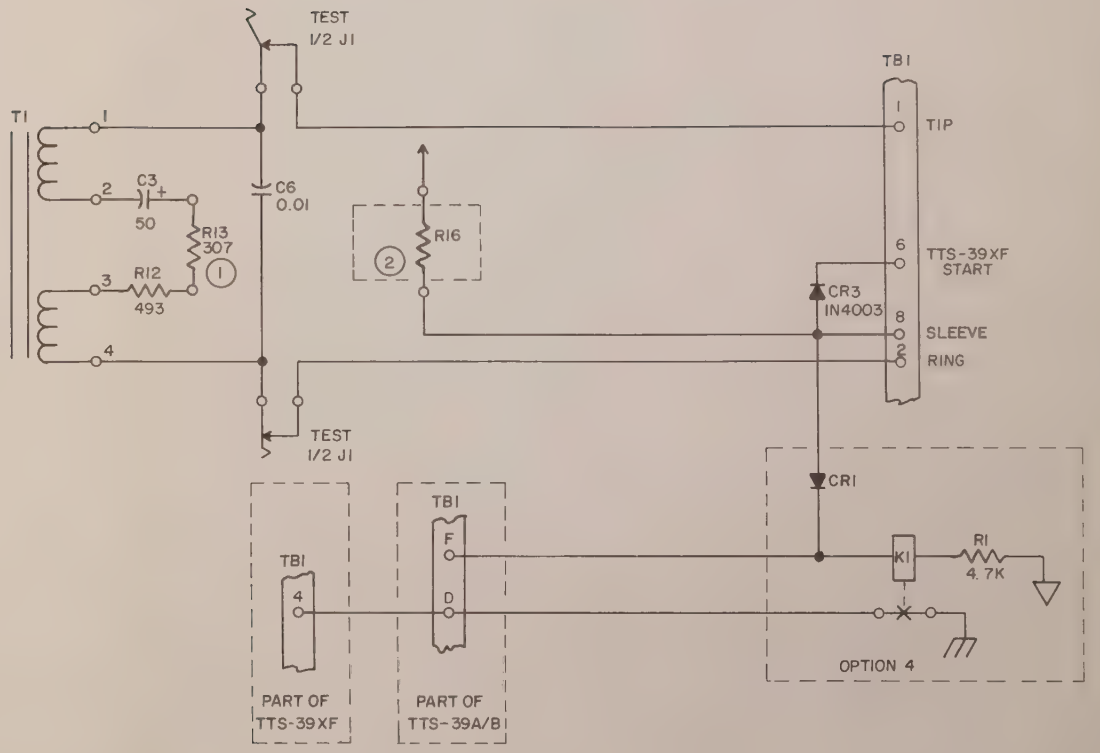
Figure 7-9. TTS 39XB Option 2
Schematic Diagram




NOTES;

1. R13 CAN BE SHORTED TO PROVIDE AN OUTPUT IMPEDANCE OF 600Ω
2. R16 NORMALLY PROVIDES A SLEEVE RESISTANCE OF 1200Ω

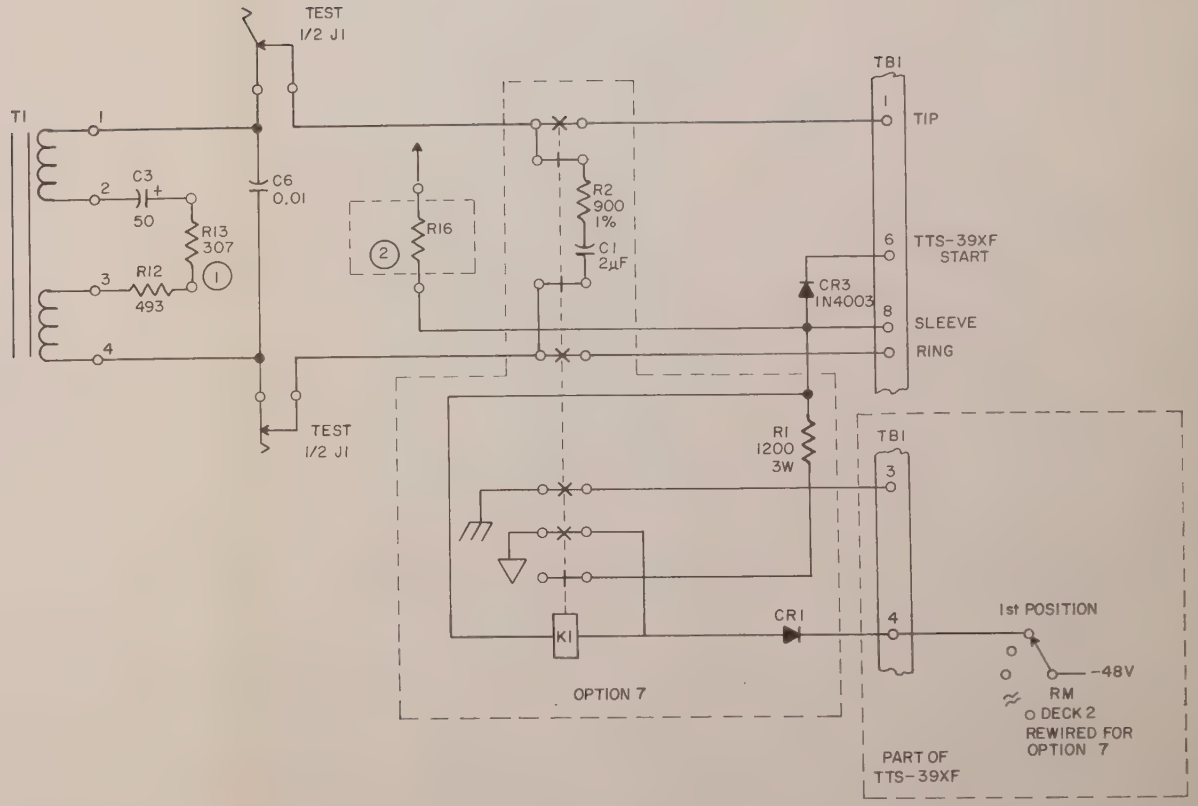
Figure 7-10. TTS 39XB Option 3 Schematic Diagram




NOTES;

1 RI3 CAN BE SHORTED TO PROVIDE AN OUTPUT IMPEDANCE OF 600Ω.
2 RI6 NORMALLY PROVIDES A SLEEVE RESISTANCE OF 1200Ω.

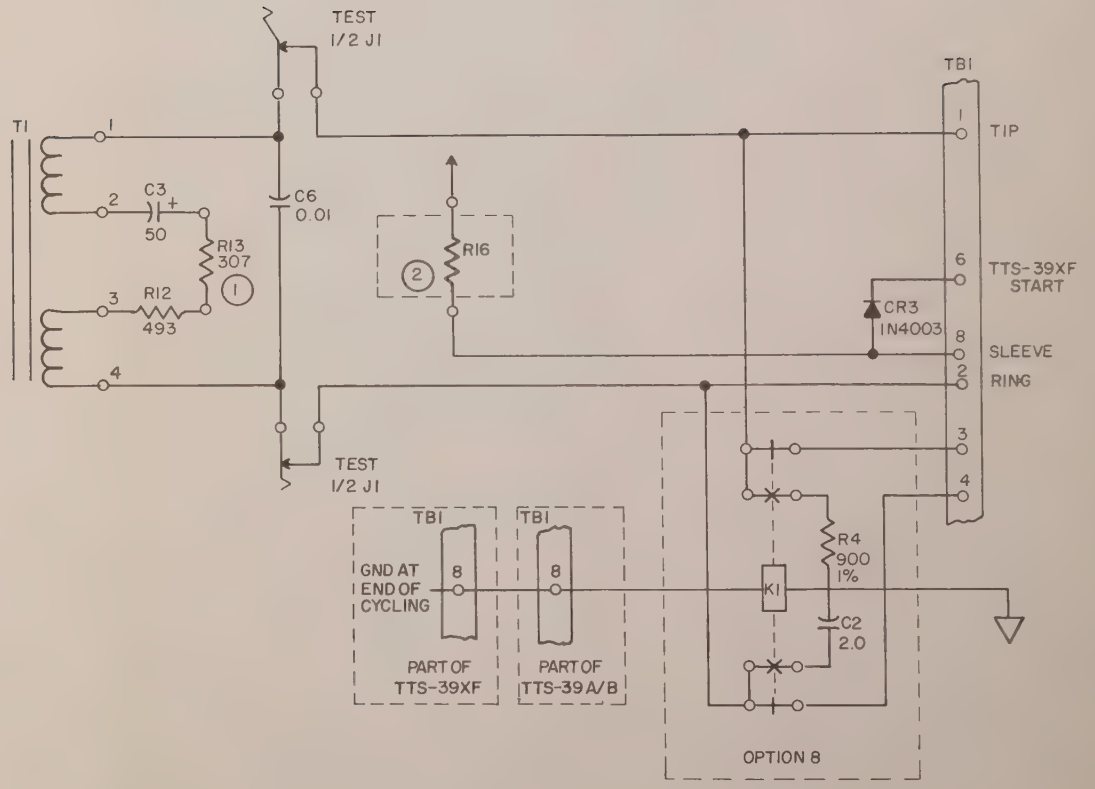
Figure 7-11. TTS 39XB Option 4 Schematic Diagram




(1) R13 CAN BE SHORTENED TO PROVIDE AN OUTPUT IMPEDANCE OF 600Ω.

(2) R16 NORMALLY PROVIDES A SLEEVE RESISTANCE OF 1200Ω.

Figure 7-12. TTS 39XB Option 7 Schematic Diagram

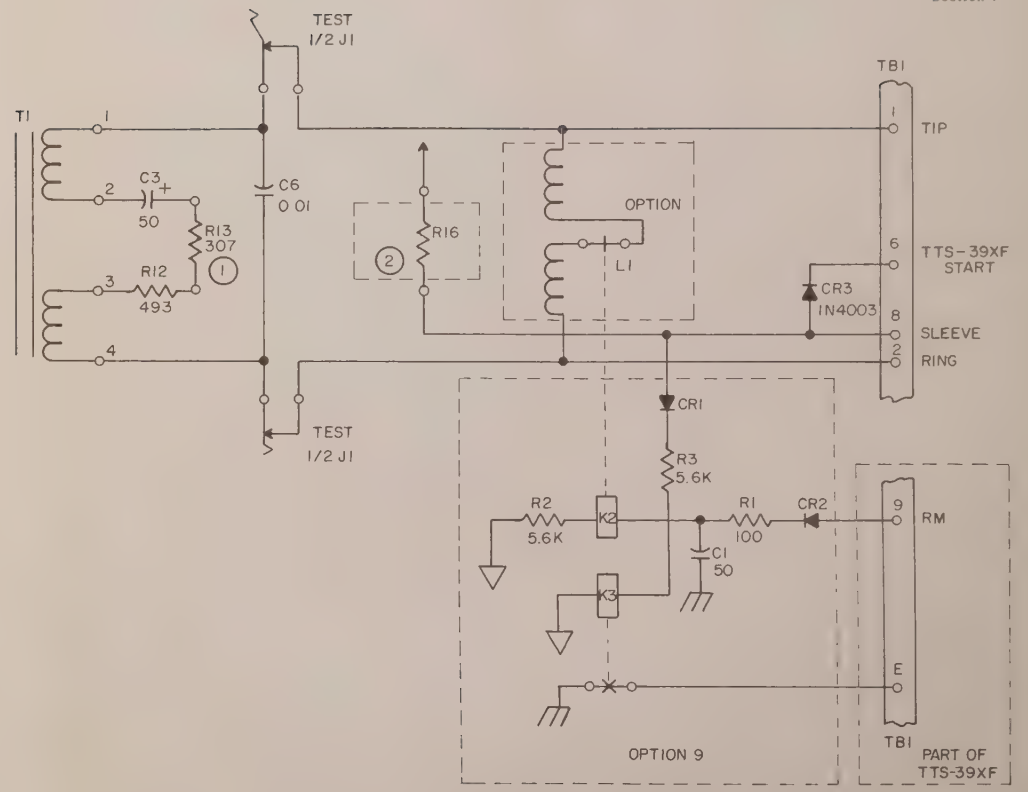



NOTES:

(1) R13 CAN BE SHORTED TO PROVIDE AN OUTPUT IMPEDANCE OF 600Ω

(2) R16 NORMALLY PROVIDES A SLEEVE RESISTANCE OF 1200Ω

Figure 7-13. TTS 39XB Option 8 Schematic Diagram




NOTES;

(1) R13 CAN BE SHORTENED TO PROVIDE AN OUTPUT IMPEDANCE OF 600Ω.

(2) R16 NORMALLY PROVIDES A SLEEVE RESISTANCE OF 1200Ω.

Figure 7-14. TTS 39XB Option 9 Schematic Diagram

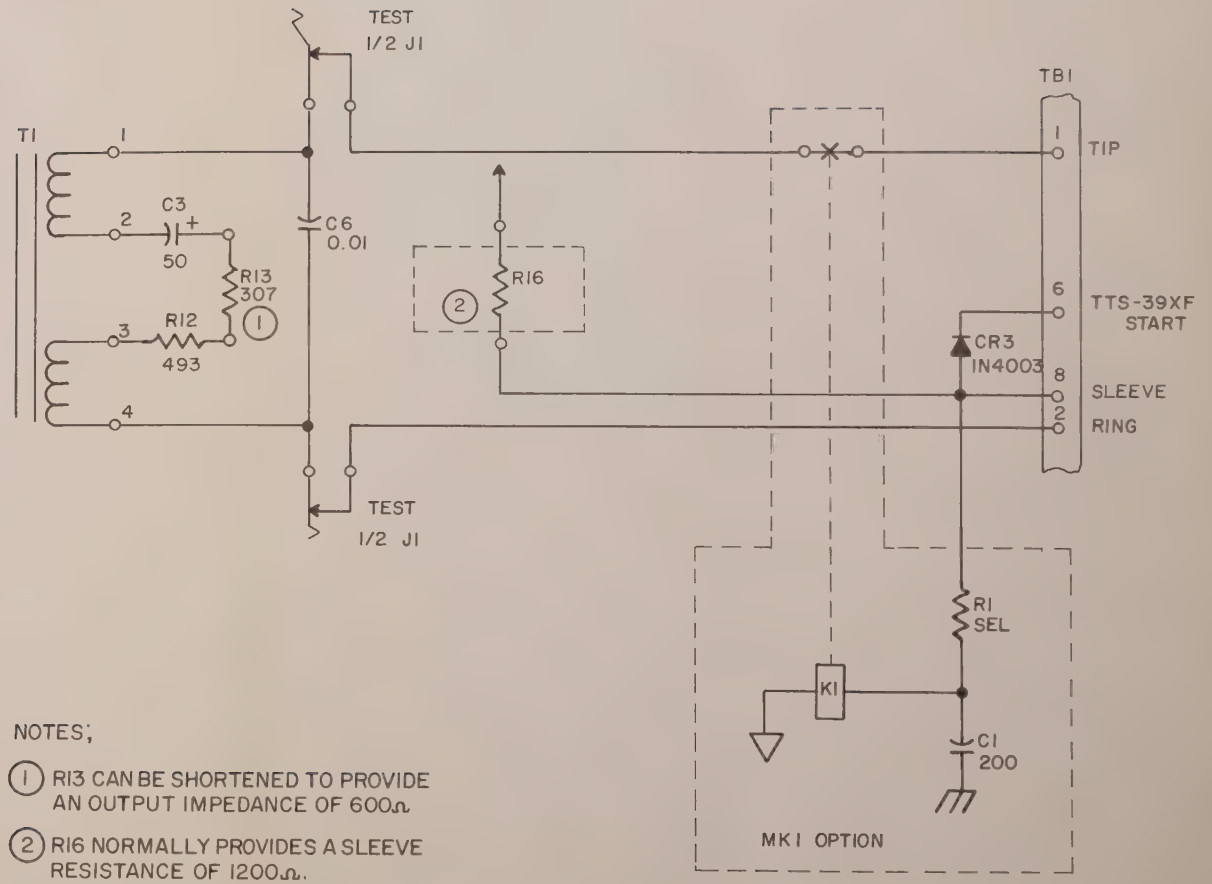



Figure 7-15. TTS 39XB MK-1 Option Schematic Diagram

# ADDENDUM A

# TTS 39 OPTION 10

**May 14, 1976**

A—1. This addendum documents TTS 39 Option 10. The option allows use of a TTS 39 Reference Tone Generator as a dialable test line. The option can be strapped for proper seizure by Number 1 ESS and Number 5 crossbar equipment, and by equipment in various other types of offices. The option can be used with a TTS 39XF frequency cycling adapter.

## A—2. CIRCUIT DESCRIPTION

A—3. Refer to the schematic diagram, Figure A—1. When adequate strapping is provided for either sleeve or ESS control, the calling signal operates relay K1. This relay will stay energized as long as the line is seized.

A—4. Operation of K1 applies battery to K2 (DOH). If the 39XF frequency cycling stepping switch is cycling at this instant, no further action will occur.

A—5. When the XF stepping switch has achieved its full cycle and returned to home position (or is in home position when K1 was first energized), then relay DOH operates 200 to 400 milliseconds after the circuit R1, DOH, C1, R2, CR2 has been completed.

A—6. Operation of relay K2 (DOH) has the following effects.

1. Ground is applied to the anodes of CR1 and CR3. CR3 allows current to flow towards the XF start circuit. Cycling starts, removing ground from the priority start lead. Relay DOH will, nevertheless, stay energized through CR1.

2. Battery is applied to relay QT. This relay will not operate at this stage due to absence of ground potential at the quiet termination lead.

3. The idle AC path composed of R3 and CR2 is opened, and simultaneously the tip lead is connected to the hold coil. This switches the line to off hook state.

4. Battery is applied to relay K5. This relay operates after a delay of approximately 200 milliseconds. The delay is set by R7 and C5.

5. The circuit operating K4 (including R5, R6, CR7) is made ready for ON HK PULSES generated by the XF stepping switch.

A—7. A K5 contact closure completes the line circuit, and tone is now sent into the calling line. Every time the XF stepping switch advances to another frequency, a short ground pulse appears at the anode of CR7. This discharges C4 and causes K4 to operate for a period of about 1 second. This time is equal to the charge time of C4 through K4 and R5. Operation of K4 opens the hold coil, thus providing a momentary return to on hook, for use in called party disconnect arrangements.

A—8. When the last XF stepped frequency terminates, the stepping switch applies ground to the quiet termination lead, causing K3 to operate (battery has already been provided by K2 operation). Operation of relay K3 has the following effects.

1. Applies ground to its own winding and thus stays energized after the XF stepping switch has returned to its home position.

2. Supplies ground to the time cycling circuit composed of U1, Q1, CR6, C6, and various resistors.

3. Opens the path between K4 and the XF stepping switch.

4. Disconnects the 39XB module output from the line and connects a 900-ohm (R4, C3) termination instead.

A—9. The time cycling circuit is now turning Q1 on every 10 seconds. If on/off hook cycling is desired with the termination connection established, a strap from D to D1 will apply a ground signal to K4 for 1 second in every 10 seconds.

## A—10. CONNECTIONS/STRAPPING

### A—11. Line Connections

A—12. Connect tip and ring leads to terminals 3 and 4 of TTS 39XB terminal block.

### A—13. Sleeve Control

A—14. Connect sleeve wire to terminal 8 of TTS-39XB terminal block. Strap pins 4-6 and 7-8 on the Option 10 printed circuit board. (Make sure no connection is made to terminals 6 and 7 of the terminal block).

### A—15. ESS

A—16. Connect ESS control leads to terminals 6 and 7 of TTS 39XB terminal block.

### A—17. Quiet Termination/Cycling Control

A—18. If on/off hook cycling is not desired when quiet termination is applied to the line, remove CR6 from the printed circuit board and remove the strap between D-D1.

A—19. **DIAGRAMS**

A—20. The following diagrams are included for reference to the TTS 39 Option 10 and its applications.

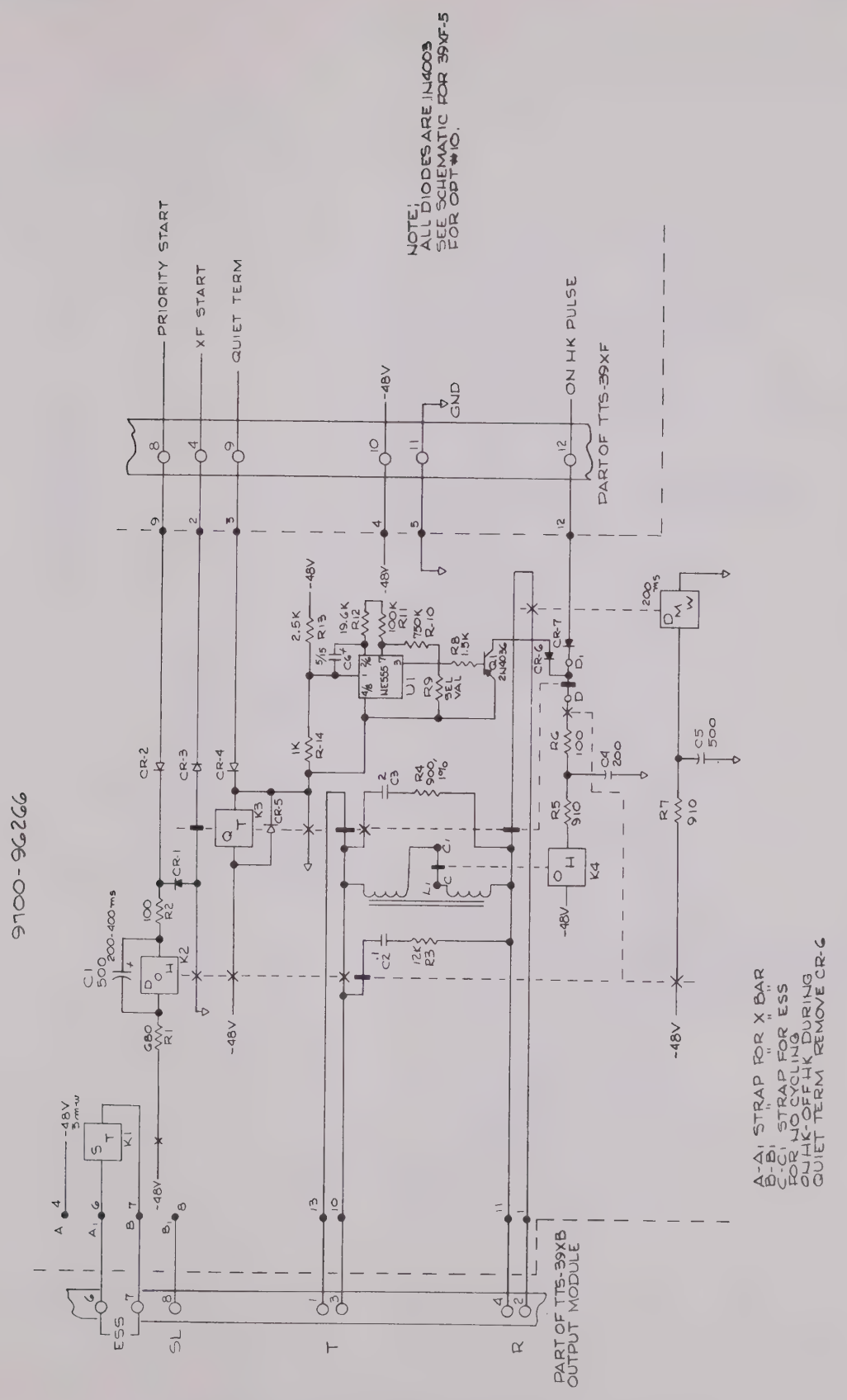
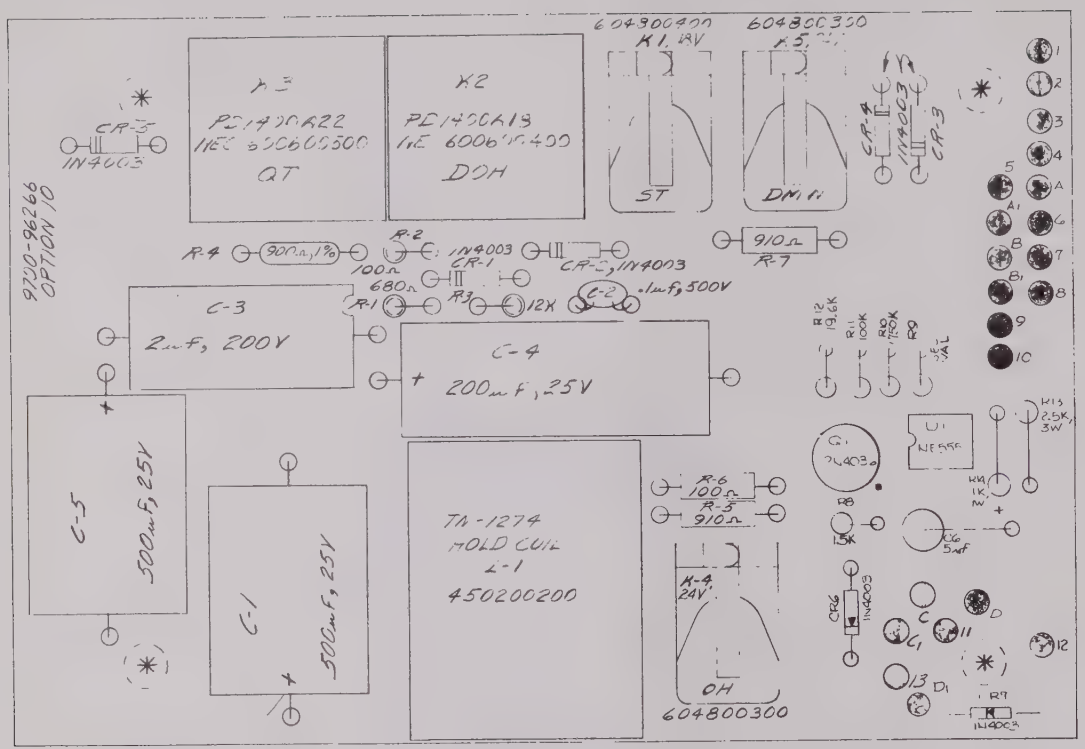



Figure A—1. Option 10 Schematic Diagram




NOTES:
1. SHADED AREAS INDICATE LARGE QUICK DISCONNECTS (THIS SIDE).
2. ✱ INDICATES STANDOFFS, HOLLOW, ¼"-6-32 (OPPOSITE SIDE).

Figure A—2. Option 10 Component Location Diagram

REPLACABLE PARTS LIST FOR ASSEMBLY C0039-70-011
TTS 39 LINE CONDITIONING PAGE 1 REV 02 DATED 5/12/76

| REFERENCE DESIGNATOR | DESCRIPTION VALUE | POWER | TOL | VOLTS | MFGR. | MFGR. PART NO. | N.E.C. PART NO. |
|---|---|---|---|---|---|---|---|
| C1 | 500UF | | | 25V | SPRAGUE | 39D507G025HE4 | 300005070 |
| C2 | .1UF | | 20% | 500V | SPRAGUE | 5GA-P10 | 330401040 |
| C3 | 2UF | | | 200V | F-DYNE | MPE11-2.0-200-10 | 301302050 |
| C4 | 200UF | | | 25V | SPRAGUE | 39D207G025EJ4 | 300002070 |
| C5 | 500UF | | | 25V | SPRAGUE | 39D507G025HE4 | 300005070 |
| C6 | 5UF | | | 16V | SPRAGUE | TE1152 | 300205050 |
| CR1-5 | D041 | | | 200V | EDAL | 1N4003 | 560040030 |
| K1 | 3.3K | 14.5MA | | 48V | MIDTEX | 210-11D100 | 604800400 |
| K2 | 6C PC TYPE H | | | | AE-NIPPON | PD1400A18-MR11N54 | 600600400 |
| K3 | 6C PC TYPE H | | | | AE-NIPPON | PD1400A22-MR11N58 | 600600500 |
| K4-5 | 830- | 29MA | | 24V | MIDTEX | 210-11C100 | 604800300 |
| L1 | 4H | | | | NEWTON | TN-1274 | 450200200 |
| Q1 | TO5MSS | 5W | | 65V | RCA | 2N4036 | 552040360 |
| R1 | 680- | 1/2W | 5% | | AB | TYPE EB | 200206815 |
| R2 | 100- | 1/2W | 10% | | AB | TYPE EB | 200201016 |
| R3 | 12K | 1/2W | 10% | | AB | TYPE EB | 200201236 |
| R4 | 900- | 1/8W | 1% | | ELECTRA | MFC5 | 220290001 |
| R5 | 910- | 1/2W | 5% | | AB | TYPE EB | 200209115 |
| R6 | 100- | 1/2W | 10% | | AB | TYPE EB | 200201016 |
| R7 | 910- | 1/2W | 5% | | AB | TYPE EB | 200209115 |
| R8 | 1.5K | 1/2W | 10% | | AB | TYPE EB | 200201526 |
| R9 | SEL. VAL. | 1/2W | | | AB | TYPE EB | 200200000 |
| R11 | 100K | 1/2W | 10% | | AB | TYPE EB | 200201046 |
| R12 | 19.6K | 1/8W | 1% | | ELECTRA | RN55 SIZE 100 PPM | 220219621 |
| R13 | 2.5K | 3W | 5% | | W LEONARD | TYPE 3X | 210302525 |
| R14 | 1K | 1W | 10% | | AB | TYPE GB | 200301026 |
| R10 | 750K | 1/2W | 5% | | AB | TYPE EB | 200207545 |
| U1 | IC, ONE-SHOT TIMER 8DILP | | | | SIGNETICS | NE 555V | 510005550 |
| XK1 | COVER DUST 210 RELAY | | | | MIDTEX | Z10-11 | 810300300 |
| XK4-5 | COVER DUST 210 RELAY | | | | MIDTEX | Z10-11 | 810300300 |

**Figure A—3. Option 10 Parts List**

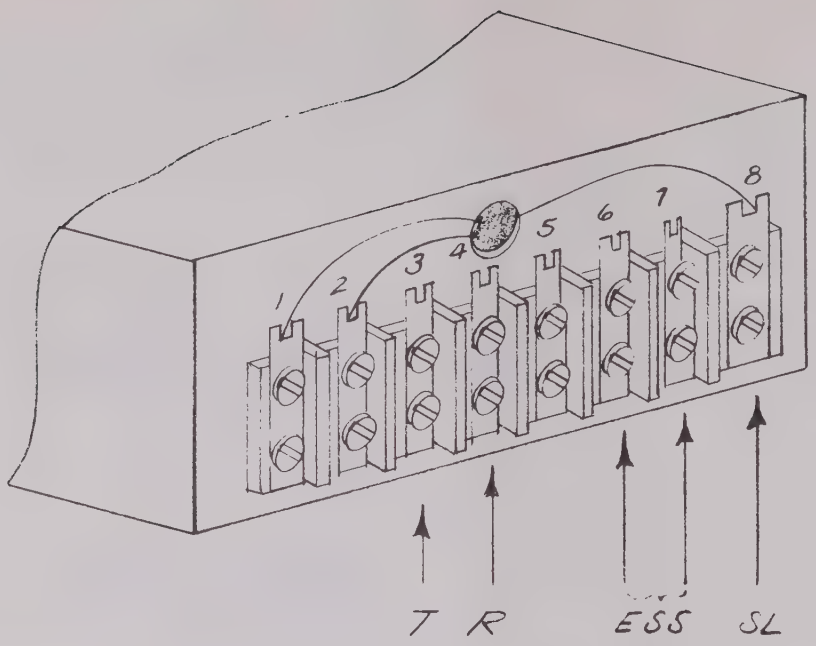



Figure A—4. Option 10 Terminal Connections

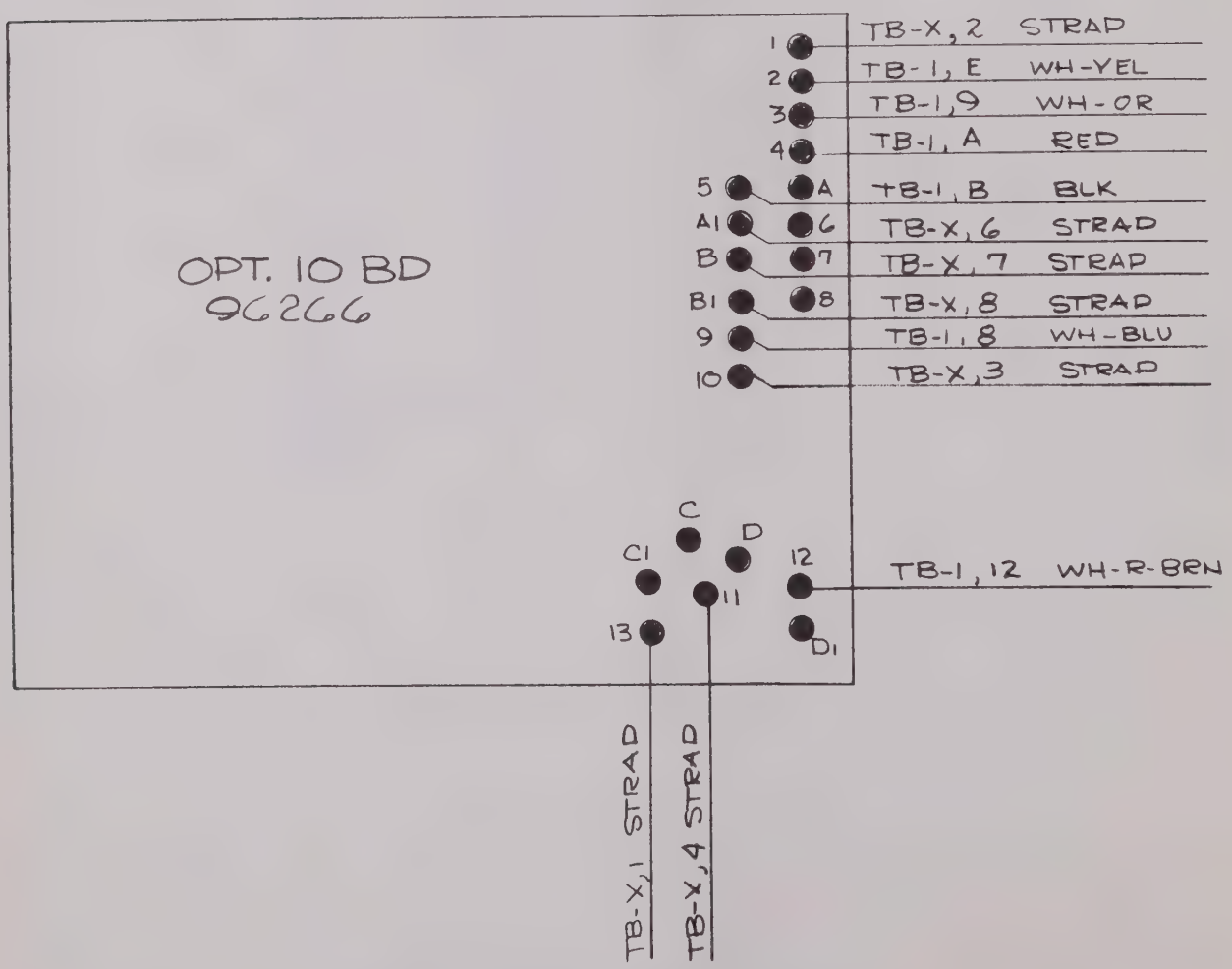



Figure A—5. Option 10 Board Strapping

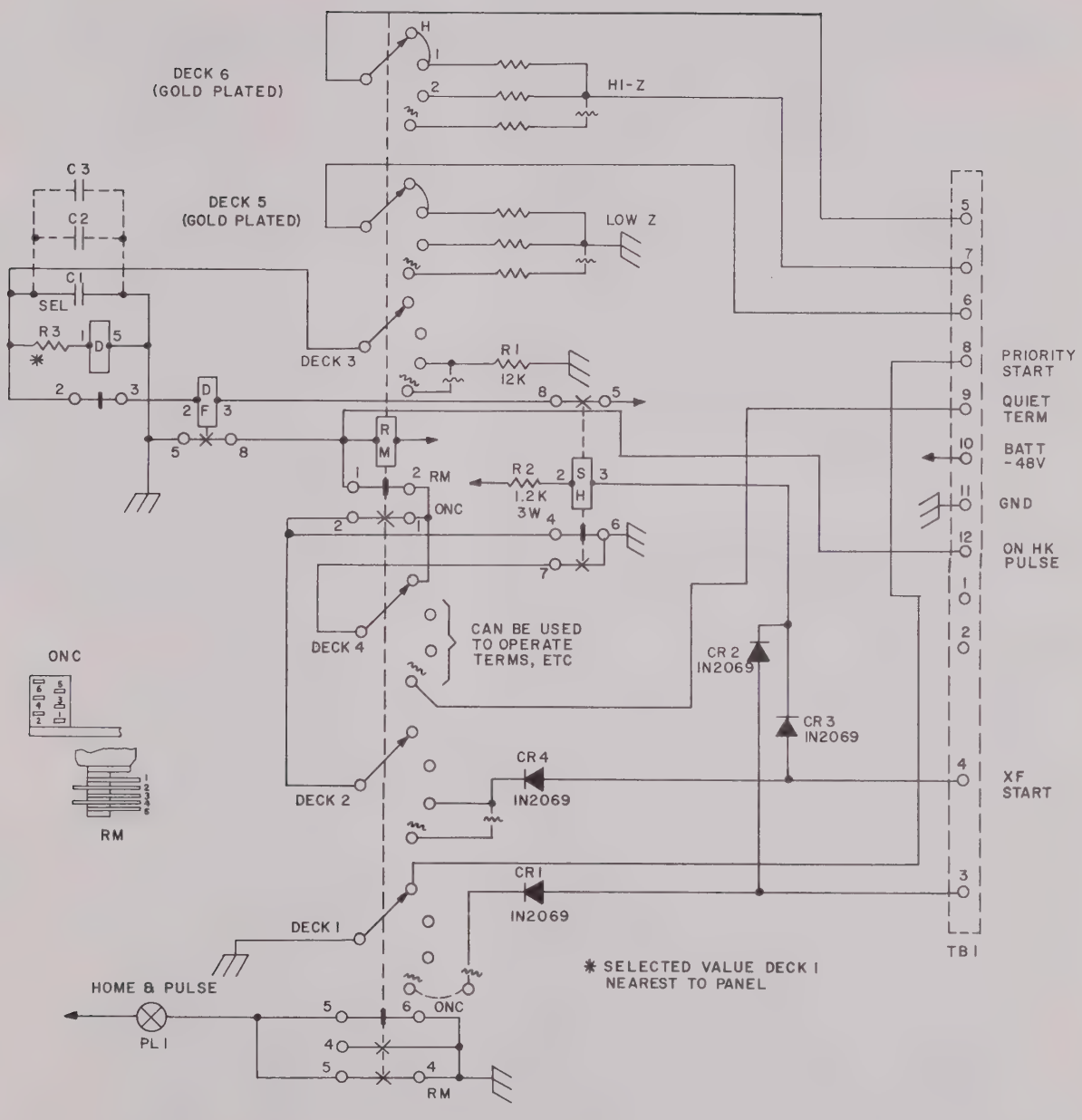



Figure A—6. TTS 39XF Schematic When Used With Option 10

# TTS 39XC

# ADDENDUM

## A.1 INTRODUCTION

A.2 This section contains all of the information required to install and make all of the interconnection wiring for the TTS 39 series.

## A.3 VISUAL INSPECTION

A.4 After unpacking the equipment, give it a thorough visual inspection to detect any damage that may have occurred during shipment. If any damage is found, report it immediately to the carrier.

## A.5 SERVICE INFORMATION

A.6 Each instrument manufactured by Northeast Electronics is warranted for a period of one year upon delivery to the original purchaser. Written authorization is required prior to the return of any equipment for factory repairs. Additional service information can be obtained by contacting Northeast Electronics Customer Service Department, P.O. Box 649, Concord, New Hampshire, 03301 or by calling 603-224-6511.

## A.7 POWER CONSIDERATIONS

A.8 The TTS 39 series is designed to operate from a voltage source within the range of 43 to 52 Vdc. The supply used must be well filtered.

## A.9 STRAPPING OPTIONS

A.10 There are several strapping options on the TTS 39XC output modules. During final testing at the factory, these straps are positioned using the information normally found on the purchase order. Before installing the equipment, inspect the strapping on the output modules to ensure that the equipment will perform as expected. Table A—1 provides a summary of the strapping options available. Figures A—1, A—2, and A—3 show the interconnections required for seizure when operating with E & M signaling interfaces.

NOTE

The output impedance of the output modules cannot be changed without recalibrating the output level.

**Table A—1. TTS 39XC Line Conditioning Board A2, Strapping Summary**

| DESIRED OPERATION/FUNCTION | STRAPPING REQUIRED |
|---|---|
| Ground sleeve seizure | A to A1 and B to B1 |
| Battery sleeve seizure | A1 to A2 and B to B1 |
| Types I and III E & M seizure | A1 to A2* |
| Type II E & M seizure | A to A1 and B1 to A2* |
| No on-hook/off-hook cycling during quiet termination | C to C1 |
| 600-ohm + 2 uF quiet termination impedance | F to F1 |
| 5.5 second tone followed by on-hook/off-hook cycling during quiet termination when not using TTS 39XF | D to D1, E to E1, and 9 to 5 (ground) |

* See Figures A—1, A—2 and A—3 for typical applications using Types I, II, and III E & M seizure.

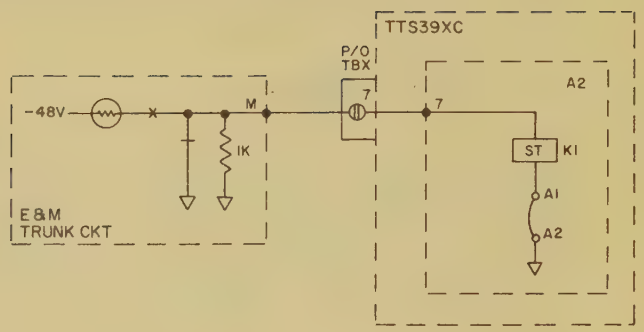



Figure A—1. Typical Type I E & M Start Control

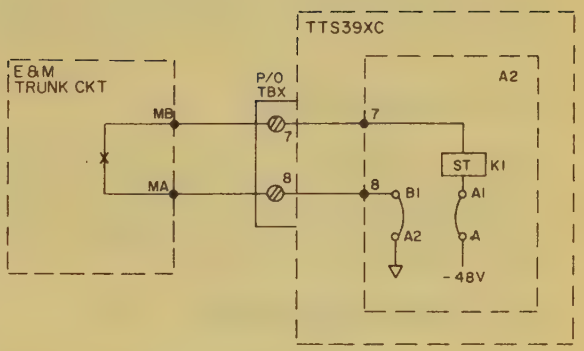



Figure A—2. Typical Type II E & M Start Control

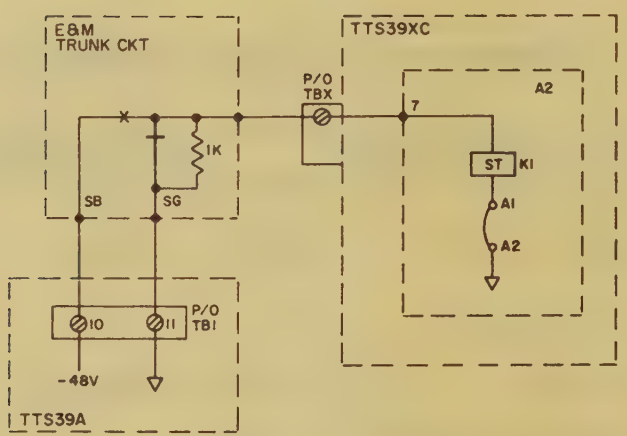



Figure A—3. Typical Type III E & M Start Control

## A.11 INSTALLATION OF TTS 39A OR TTS 39D WITH TTS 39XB/XC MODULES

A.12 To install either a TTS 39A or a TTS 39D, perform the following steps.

1. Install the unit in a standard 19-inch rack. See Figure A—4 for the rack space requirements.

2. Refer to Table A—2 for the TTS 39A installation wiring information and Table A—3 for the TTS 39D.

NOTE

When using the TTS 39XB for an office milliwatt source, it is recommended that only one jack per output module be used. If jacks are multipled, simultaneous access by more than one user at a time must be prevented. Some type of busy light system would be satisfactory.

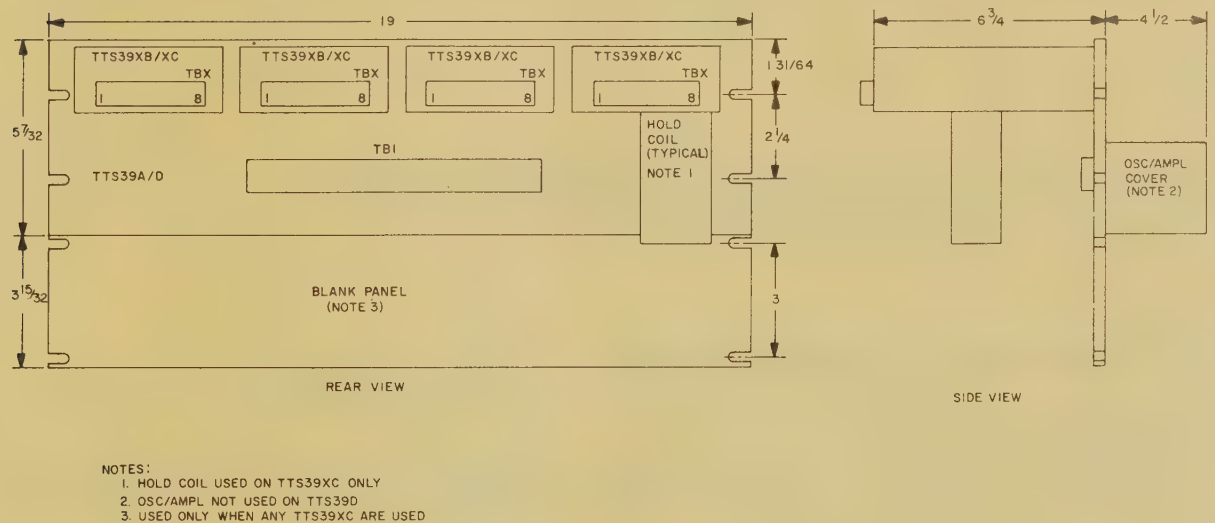



**Figure A—4. TTS 39A/D With TTS 39XB/XC Output Modules, Outline Drawing**

**Table A—2. TTS 39A Installation Wiring**

| FROM TTS 39A TB1 PIN | TO | FROM EACH TTS 39XB TBX PIN | TO ASSOCIATED OFFICE MW JACK | FROM EACH TTS 39XC TBX PIN | TO SWITCH EQUIPMENT |
|---|---|---|---|---|---|
| 1 | −48 Vdc | 1 | tip | 3 | tip |
| 2 | ground | 2 | ring | 4 | ring |
| | | | | 8 ↓ or ↓ 7 & 8 | sleeve if used for start<br>See Figures A—1, A—2 and A—3 |

**Table A—3. TTS 39D Installation Wiring**

| FROM TTS 39D TB1 PIN | TO | FROM EACH TTS 39XB TBX PIN | TO ASSOCIATED OFFICE MW JACK | FROM EACH TTS 39XC TBX PIN | TO SWITCH EQUIPMENT |
|---|---|---|---|---|---|
| – | –48 Vdc | 1 | tip | 3 | tip |
| + | ground | 2 | ring | 4 | ring |
| IN 1 | TTS 39A TB1-12* | | | 8 ↓ or ↓ 7 & 8 | sleeve if used for start<br>See Figures A—1, A—2, and A—3 |

* The first TTS 39D when more than one is used. The IN 1 terminal on the second unit connects to the BUFF OUT terminal on the first. Repeat for other units in the chain.

A.13 **INSTALLATION OF TTS 39A AND TTS 39XF**

A.14 To install a TTS 39A and a TTS 39XF, perform the following steps.

1. Install the unit in a standard 19-inch rack. See Figure A—5 for the rack space requirements.

2. Refer to Table A—4 for the wiring information.

A.15 **INSTALLATION OF TTS 39XB INTO TTS 39A OR TTS 39D**

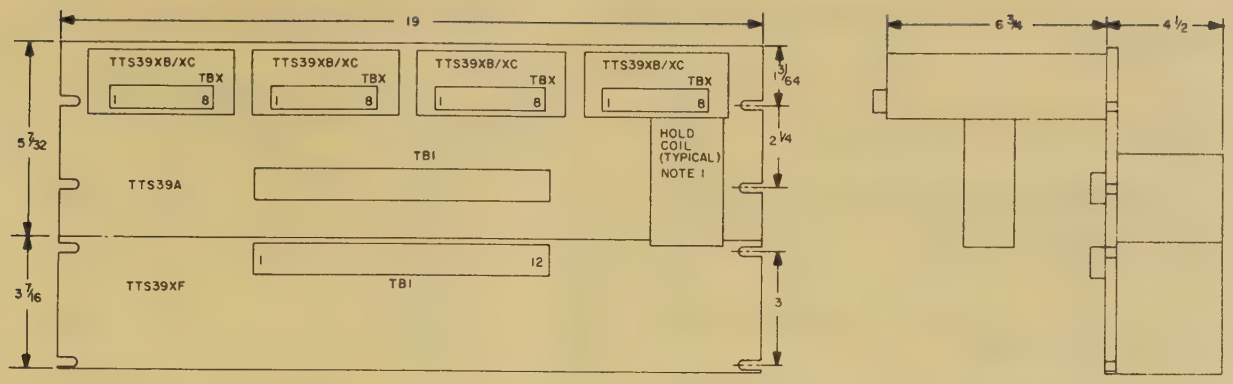
A.16 To install a TTS 39XB into either a TTS 39A or a TTS 39D, perform the following steps.

1. Orient the TTS 39XB such that the dust cover is up and insert the potentiometers and access jack through the front panel from the rear.

2. Secure the TTS 39XB with four screws inserted through the front panel.

3. There are three wires twisted together that exit from the TTS 39XB. Solder the red wire to the closest pin A on TB1, the black wire to the closest pin B, and the white/brown wire to the closest pin C.

4. Connect the tip, ring, and sleeve (if required) as instructed in either Table A—3 or A—4 as appropriate.




NOTES:
1. HOLD COIL USED ON TTS39XC ONLY.

**Figure A—5. TTS 39A With TTS 39XB/XC Output Modules and TTS 39XF, Outline Drawing**

**Table A—4. TTS 39A/TTS 39XF Installation Wiring**

| FROM TTS 39A TB1 PIN | TO | FROM EACH TTS 39XB TBX PIN | TO ASSOCIATED OFFICE MW JACK | FROM EACH TTS 39XC TBX PIN | TO SWITCH EQUIPMENT |
|---|---|---|---|---|---|
| 1 | −48 Vdc | 1 | tip | 3 | tip |
| 2 | ground | 2 | ring | 4 | ring |
| | | 8 | N.O. transfer contact | 8 ↓ or ↓ 7 & 8 | sleeve is used for start<br>See Figures A—1, A—2, and A—3 |

## A.17 INSTALLATION OF TTS 39XC INTO TTS 39A OR TTS 39D.

A.18 To install a TTS 39XC into either a TTS 39A or a TTS 39D, perform the following steps.

1. Orient the TTS 39XC such that the circuit board is down and insert the potentiometers and jack through the front panel from the rear.

2. Secure the TTS 39XC with four screws inserted through the front panel.

3. There is a group of wires connected to stand-off terminals on the edge of circuit board A2. Connect these wires as indicated in Table A—5.

4. Connect the tip, ring, and control lead(s) from the TBX as indicated in Table A—3, under the TTS 39XC column.

**Table A—5. TTS 39XC Installation Wiring**

| FROM TTS 39 XC BOARD A2 PIN | TO TTS 39A/D TB1 PIN | FUNCTION |
|---|---|---|
| 4 | 10 | —48 VDC |
| 5 | 11 | GROUND |
| 9 | 8 | PRI START |
| 2 | 4 | XF START |
| 3 | 9 | QUIET TERM |
| 12 | 3 | ON-HK PULSE |

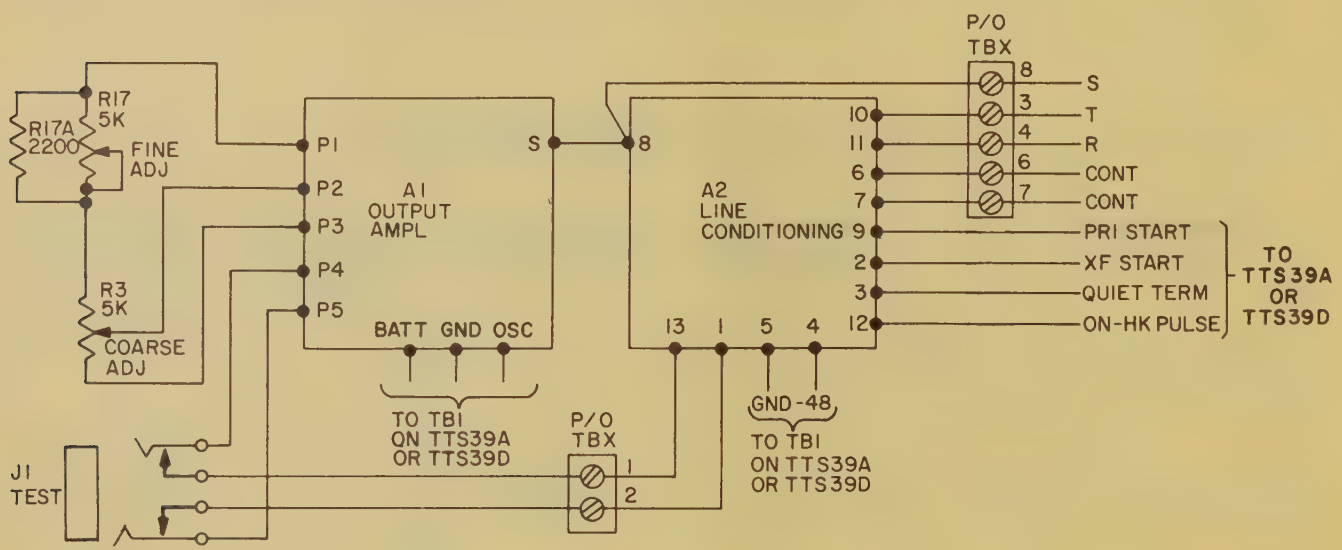
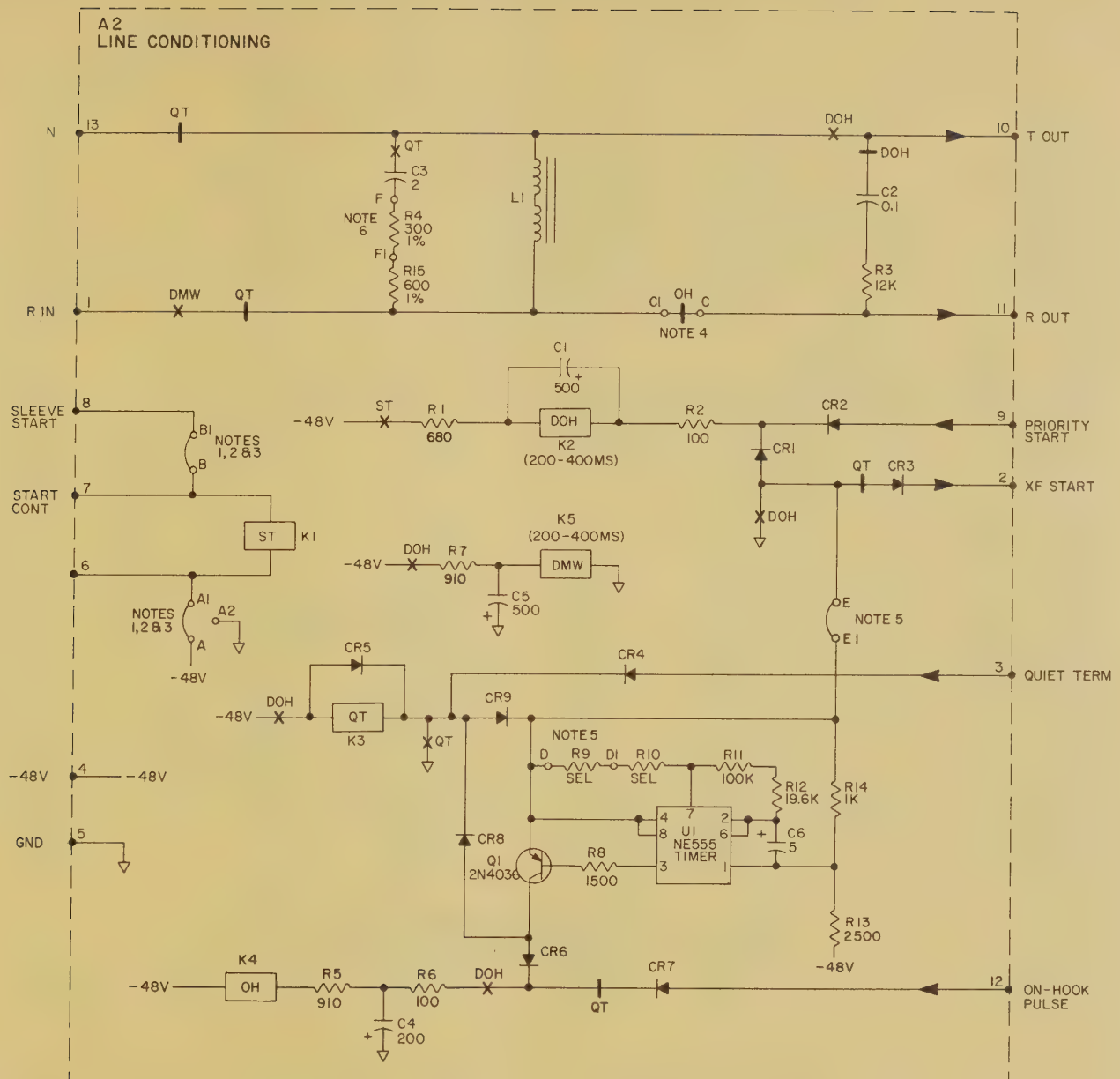



**Figure A—6. TTS 39XC Interconnection Diagram**




NOTES:
1. FOR GROUND SLEEVE SEIZURE STRAP A-A1 & B-B1.
2. FOR BATTERY SLEEVE SEIZURE STRAP A1-A2 & B-B1.
3. FOR TYPES I & III E & M, STRAP A1-A2.
   FOR TYPE II E & M, STRAP A-A1 & B1-A2.
4. FOR NO ON HK/OFF HK CYCLING STRAP C-C1.
5. WHEN NOT USING TTS39XF, STRAP D-D1 FOR 5.5 SEC TONE AND STRAP E-E1 FOR ON HK/OFF HK CYCLING AFTER TONE. ALSO STRAP 9 TO 5 (GND).
6. FOR 600 OHMS STRAP F-F1. OMIT FOR 900 OHMS.
7. RESISTORS ARE IN OHMS & CAPACITORS IN MICROFARADS.
8. ALL DIODES ARE IN4003.

| | |
|---|---|
| REF DES | A2 |
| P/N | C00397001I |
| I.D. NO. | 96266 |

D01510

**Figure A—7. TTS 39XC Line Conditioning Board A2, Schematic Diagram**

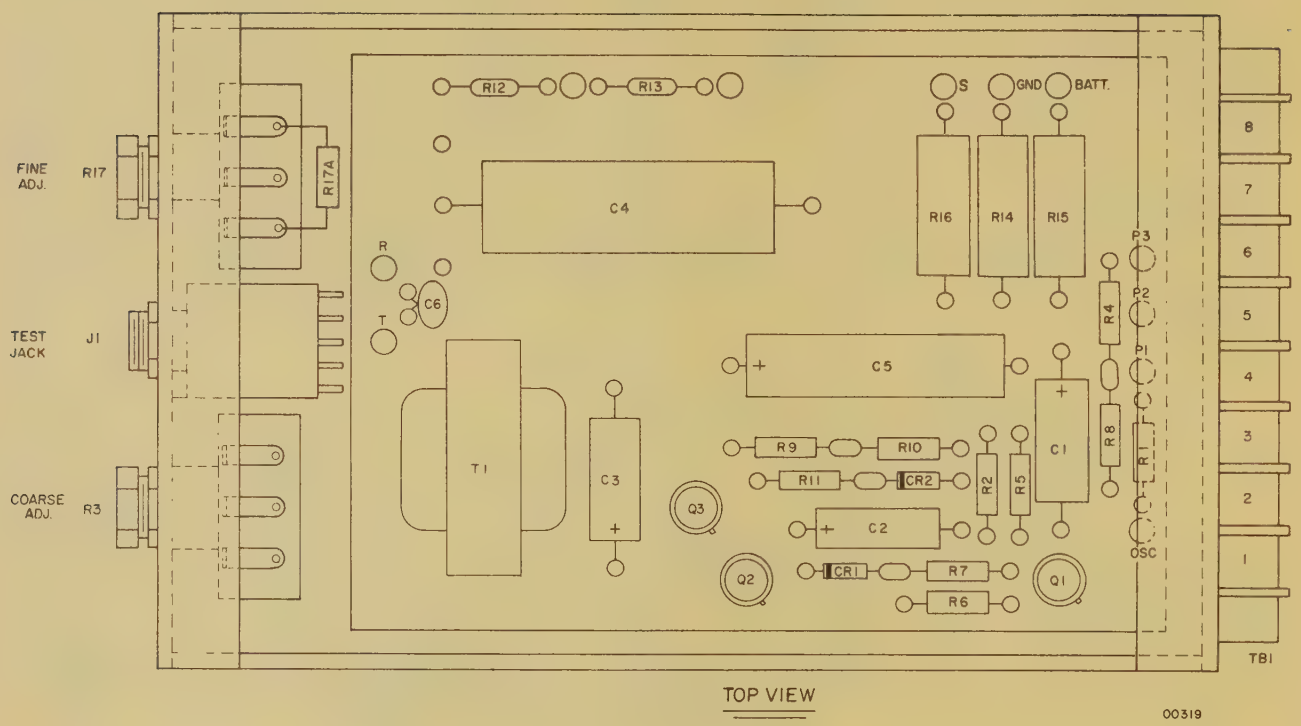
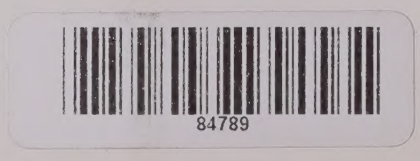



**Figure A—8. TTS 39XC Line Conditioning Board A2, Component Location**

## Table A—6. TTS 39XC Line Conditioning Board A2 Parts List

| REFERENCE DESIGNATOR | DESCRIPTION VALUE | POWER | TOL | VOLTS | MFGR. | MFGR. PART NO. | N.E. PART NO. |
|---|---|---|---|---|---|---|---|
| C1 | 500UF | | | 25V | SPRAGUE | 39D507G025HE4 | 300005070 |
| C2 | .1UF | | 20% | 500V | SPRAGUE | 5GA-P10 | 330401040 |
| C3 | 2UF | | | 200V | F-DYNE | MPE11-2.0-200-10 | 301302050 |
| C4 | 200UF | | | 25V | SPRAGUE | 39D207G025EJ4 | 300002070 |
| C5 | 500UF | | | 25V | SPRAGUE | 39D507G025HE4 | 300005070 |
| C6 | 5UF | | | 16V | SPRAGUE | TE1152 | 300205050 |
| CR1-9 | D041 | | | 200V | EDAL | 1N4003 | 560040030 |
| K1 | 3.3K | 14.5MA | | 48V | MIDTEX | 210-11D100 | 604800400 |
| K2 | 6C PC TYPE H | | | | AE-NIPPON | PD1400A18-MR11N54 | 600600400 |
| K3 | 6C PC TYPE H | | | | AE-NIPPON | PD1400A22-MR11N58 | 600600500 |
| K4-5 | 830- | 29MA | | 24V | MIDTEX | 210-11C100 | 604800300 |
| L1 | 4H | | | | NEWTON | TN-1274 | 450200200 |
| Q1 | TO5MSS | 5W | | 65V | RCA | 2N4036 | 552040360 |
| R1 | 680- | 1/2W | 5% | | AB | TYPE EB | 200206815 |
| R2 | 100- | 1/2W | 10% | | AB | TYPE EB | 200201016 |
| R3 | 12K | 1/2W | 10% | | AB | TYPE EB | 200201236 |
| R4 | 300- | 1/8W | 1% | | ELECTRA | RN55 SIZE 100 PPM | 220230001 |
| R5 | 910- | 1/2W | 5% | | AB | TYPE EB | 200209115 |
| R6 | 100- | 1/2W | 10% | | AB | TYPE EB | 200201016 |
| R7 | 910- | 1/2W | 5% | | AB | TYPE EB | 200209115 |
| R8 | 1.5K | 1/2W | 10% | | AB | TYPE EB | 200201526 |
| R9-10 | SEL.VAL. | 1/2W | | | AB | TYPE EB | 200200000 |
| R11 | 100K | 1/2W | 10% | | AB | TYPE EB | 200201046 |
| R12 | 19.6K | 1/8W | 1% | | ELECTRA | RN55 SIZE 100 PPM | 220219621 |
| R13 | 2.5K | 3W | 5% | | W LEONARD | TYPE 3X | 210302525 |
| R14 | 1K | 1W | 10% | | AB | TYPE GB | 200301026 |
| R15 | 600- | 1/8W | 1% | | ELECTRA | RN55 SIZE 100 PPM | 220260001 |
| U1 | IC,ONE-SHOT TIMER 8DILP | | | | SIGNETICS | NE 555V | 510005550 |
| XK1 | COVER DUST 210 RELAY | | | | MIDTEX | Z10-11 | 810300300 |
| XK4-5 | COVER DUST 210 RELAY | | | | MIDTEX | Z10-11 | 810300300 |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